NCE LIBRARY

McGraw-Hill Publishing Company, Inc. NOVEMBER 20, 1926 Price Twenty-five Cents Per Copy

ENGINEERING AND MINING JOURNAL

A Consolidation of Engineering and Mining Journal and Mining and Scientific Press

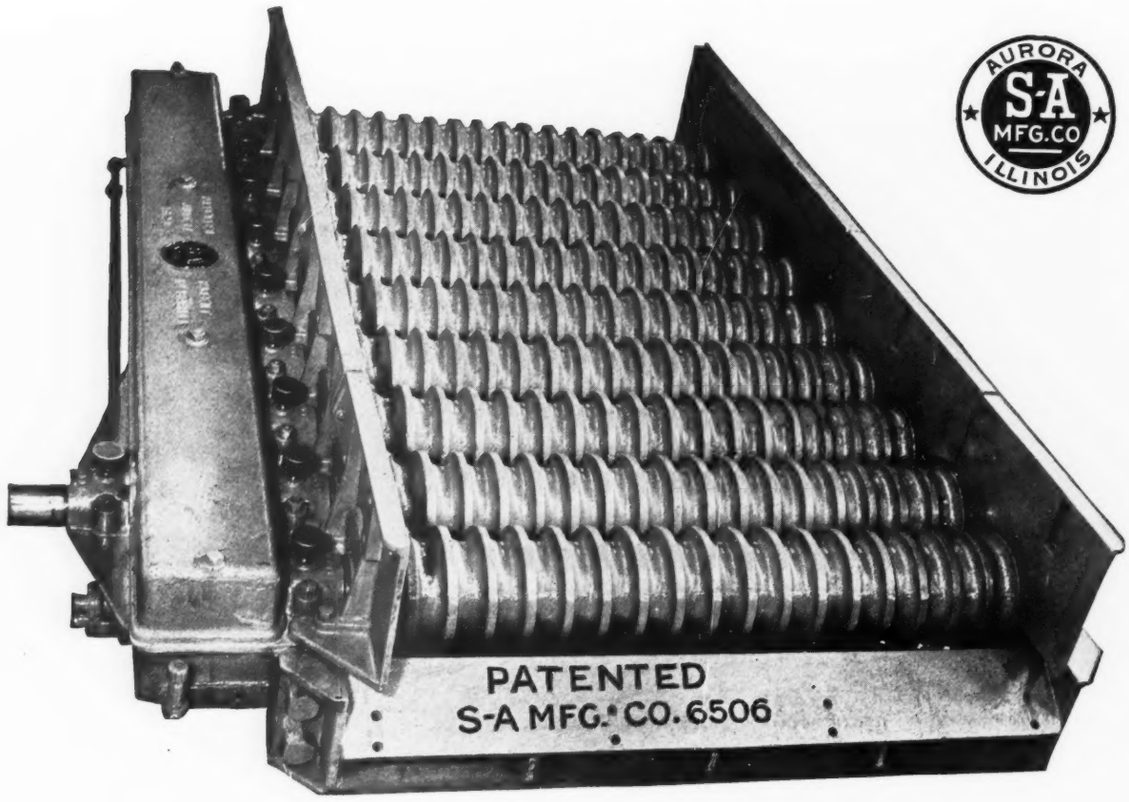
METAL AND NON-METALLIC MINING · MILLING · SMELTING · REFINING · MARKETING

Storing Commercial Explosives
By Edwin B. Jones

Phosphate Deposits of the World
By George Rogers Mansfield

Is There a Canyon Diablo Meteorite?
By F. Le Roi Thurmond

Behavior of Silver in Concentrating Coeur d'Alene Ores
By Ernest W. Ellis



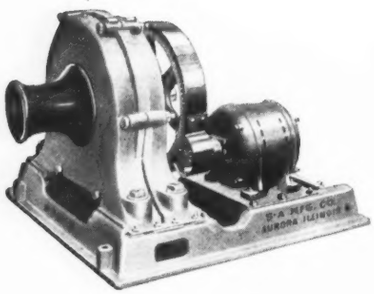
High efficiency separation —long wear

The heaviest loads will not injure this new S-A Live Roll Grizzly. It's sturdy enough to stand the heaviest chunks, and the live rolls, each turning at a different speed, insure complete by-passing of all undersize.

Several features establish this Grizzly as an important advance in the design of equipment for this service.

Its construction comprises a heavy rigid frame carrying a series of cross shafts on which are mounted the spools. Each successive spool is operated at an increased speed, eliminating any opportunity for the wedging of material in the openings, and the oversize is carried over on the periphery of the faster spool.

Most of the undersize drops through the first openings, the remainder being certain to fall through. The wavy motion imparted to the load causes fines to work down through the load. The entire machine is operated at slow speed.



S-A Car Pullers

Motor is mounted on the frame of this S-A Car Puller, driving the Car Puller through cut gears. This type of Car Puller is very compact and powerfully built.

STEPHENS-ADAMSON
MFG. CO. AURORA, ILL.

Volume 122 New York, November 20, 1926 *Number* 21

ENGINEERING AND MINING JOURNAL

J. E. SPURR, Editor

GEORGE J. YOUNG, Associate Editor, San Francisco, Calif. T. A. RICKARD, Contributing Editor, San Francisco, Calif.
A. H. HUBBELL, Managing Editor
E. H. ROBIE, A. B. PARSONS, ALBERT H. FAY, W. N. P. REED, E. J. GEALY, Assistant Editors
Tenth Ave. at 36th St., New York, N. Y.
883 Mission St., San Francisco, Calif. Colorado Building, Washington, D. C.

Contents

*Illustrated Article

Editorials 801
- Investment of a Surplus
- Public Roads and Assessment Work
- A Drifting Record?
- Lodes and Apexes
- Competent Advice Needed
- Julian Merger Mines, Inc.
- Forced Recovery of Petroleum
- Making Industry Noiseless

*Storing Commercial Explosives 804
By Edwin B. Jones

*Phosphate Reserves Ample for 2,000 years 810
By George Rogers Mansfield

*Solving a Problem in Silver-Lead Ore Concentration 815
By Ernest W. Ellis

*Is There a Canyon Diablo Meteorite? 817
By F. Le Roi Thurmond

Discussion 819
- Certain Geological Features of Bolivian Tin-Bearing Veins
- Underground Orientation by the F. J. Weiss Method
- Why Bother the Engineer?

Searchlight Section 48-50

Professional Directory 51

Consultation 822
- Corduroy for Recovering Free Gold
- Lead-Zinc Ore Schedules
- Principal Lead Producers

Mining News 823
- Calles Asks Modification of Mexican Mining Laws
- Tungsten Tariff
- Reclamation Work at Barnes-Hecker Mine
- Washington News
- Letters From Toronto, London, Melbourne and Johannesburg

Societies, Addresses and Reports 830

Men You Should Know About 831

Obituaries 831

Recent Technical Publications 832

Oklahoma Publications 832

New Machinery 833

Market and Financial News 835

Markets 837

Freight Rates 839

Mining Stocks 840

What and Where to Buy 54

Advertising Index 58

McGRAW-HILL PUBLISHING COMPANY, INC., Tenth Ave. at 36th St., New York, N. Y.

JAMES H. McGRAW, President
JAMES H. McGRAW, Jr., Vice-Pres. and Treas.
MALCOLM MUIR, Vice-President
EDWARD J. MEHREN, Vice-President
MASON BRITTON, Vice-President
EDGAR KOBAK, Vice-President
C. H. THOMPSON, Secretary

WASHINGTON, Colorado Building
CHICAGO, 7 S. Dearborn Street
PHILADELPHIA, 1600 Arch St
CLEVELAND, Guardian Building
ST. LOUIS, Star Building
SAN FRANCISCO, 883 Mission Street
LONDON, 6 Bouverie St., London, E. C. 4

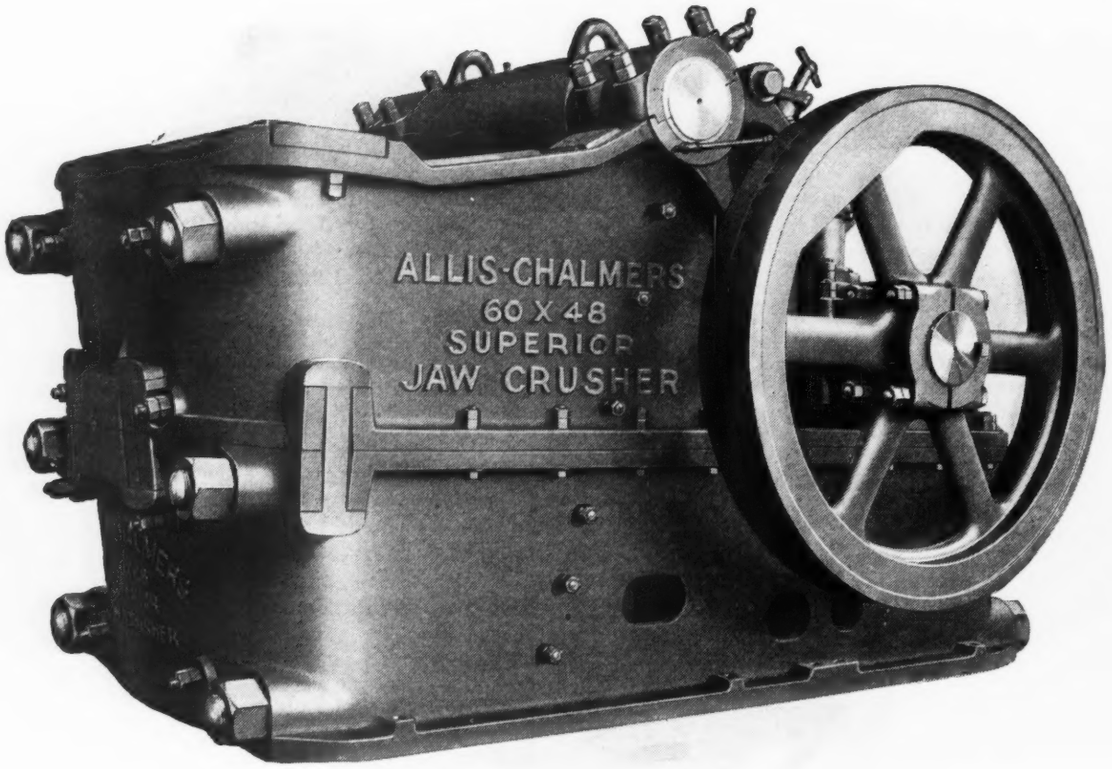
Cable Address: "Machinist, N. Y."
Copyright 1926
By McGraw-Hill Publishing Company, Inc.
Publishers of

Engineering News-Record **American Machinist**
Power **Chemical and Metallurgical Engineering**
Coal Age **Engineering and Mining Journal**
Ingeniería Internacional
Electrical World **Electrical Merchandising**
Bus Transportation **Electric Railway Journal**
Industrial Engineer **Radio Retailing**
Successful Methods
Journal of Electricity
(Published in San Francisco)
American Machinist—European Edition
(Published in London)

11,680 COPIES PRINTED THIS ISSUE

The annual subscription rate in the United States, Canada, Mexico, Alaska, Hawaii, Philippines, Porto Rico, Canal Zone, Honduras, Cuba, Nicaragua, Peru, Colombia, Bolivia, Dominican Republic, Panama, El Salvador, Argentina, Brazil, Spain, Uruguay, Costa Rica, Ecuador, Guatemala, Chili, Haiti and Paraguay, $5 per year. Extra foreign postage, $3 (total $8 or 34 shillings). Single copy, 25c. Change of Address—When change of address is ordered the new and the old address must be given. Notice must be received at New York at least ten days before the change takes place. Published weekly. Entered as second-class matter June 20, 1879, at the Post Office at New York, N. Y., under the Act of March 3, 1879.
Printed in U. S. A.
Member Audit Bureau of Circulations.
Member Associated Business Papers, Inc.

JAW CRUSHERS



Sizes 15 in. x 10 in. to 60 in. x 48 in.

Rugged Construction Large Capacity

ALLIS-CHALMERS

MILWAUKEE, WIS. U. S. A.

ENGINEERING AND
MINING JOURNAL

JOSIAH EDWARD SPURR, Editor

Volume 122 | New York, November 20, 1926 | *Number* 21

Investment of a Surplus

"IT TAKES," said one of the London Rothschilds, a famous financier, "a good deal of shrewdness and a great deal of boldness to acquire a fortune; it takes a far greater degree of wisdom, mixed with a greater degree of courage, to retain it." In conjunction with this it is to be remembered that at the close of the World War bankers universally cited Rothschild's counsel at the close of the Franco Prussian War: "Buy francs. The credit of France is guaranteed by the thrifty nature of her people." Whoever bought francs —in the form of bonds, mortgages, or other franc securities—has seen his principal dwindle to $171 for each $1,000 invested—thus proving the accuracy of the first of the Rothschild observations, if not of the second.

Similar losses, varying in percentages to 100 per cent, or total loss of capital, mark all those countries whose currencies became depreciated, when the stabler position of the dollar caused it to assume the position of world standard. But the investors of the United States, who had invested in dollars, in the form of bonds or mortgages, did not escape. The value of the dollar, in purchasing power, became halved as a result of the war, and now has adjusted itself so that it is two-thirds of the pre-war value; and the pre-war investor, in being paid the face value of a security when it matures, or in selling it, receives back essentially two-thirds of his original capital. If he had invested in natural wealth, like real estate, he would have seen its value rise as the value of the dollar shrunk, or even more rapidly; and his capital would be intact, or aggrandized. Had he bought stock instead of bonds, he would have become a partner in industrial enterprises, instead of a lender of dollars to them; and inflation would have carried up the value of his stock, if he had selected sound enterprises, in proportion to or faster than the dwindling value of the dollar.

These facts have been pointed out recently by various students of finance. An investor in bonds, they point out, is speculating as to the future trend of purchasing value of the dollar. Which of these speculations will he choose: the one just mentioned, or that involving the guess as to the future prosperity of the enterprises he may buy into as stockholder? The financial students above mentioned, looking back, find that over a term of years he who chose the speculation in stocks would on the average have fared far better than if he invested in bonds.

This experience is of course made into a maxim for the future. It may so apply: or it may fail, as Rothschild's advice after the Franco Prussian War failed after the Great War. Should the value of the dollar rise in purchasing power over a period of years, the purchaser of bonds now would receive more than his original capital back, when they mature, or when he sells. Both from experience and theory, this is what is likely to happen; the abnormally high prices (with corresponding diminished value of the dollar) which succeeded the Civil War did not wholly disappear for ten years thereafter, but finally did so. This process, following the World War, is now taking place, being lengthened by the slow recovery of Europe and its productive powers; barring another great war, however, it apparently must continue. Mass production will contribute favorably toward this increase of the purchasing value of the dollar; and the increase of capital gradually released by the rehabilitation of Europe should tend to diminish the average interest return, and so raise the market value of existing bonds. Therefore it would appear that those mining companies which are accustomed to hold a substantial surplus in bonds may continue with wisdom to do so, equally with the insurance companies, which are among the largest investors; and the same applies to individuals.

Public Roads and Assessment Work

ELK CITY, IDAHO, will soon be connected with the outside world by a public highway now under construction, from Grangeville, 55 miles distant. To hasten the completion of this highway the citizens of Elk City last April organized the Elk City-South Fork Highway Association, and asked the Bureau of Public Roads to set grade stakes on a four-mile section of the Elk City end. The association called a meeting at Elk City in July and the following resolution was addressed to A. H. Connor, attorney general, Boise, Idaho:

"Resolved, that optional with claim owners, assessment work may be performed or done upon trunk roads within or leading to the Elk City mining district."

The attorney general replied that this matter was outside of his jurisdiction and referred the association to the state mine inspector. The inspector gave the following opinion: "In view of the court decisions and my knowledge of the conditions in the Elk City mining district, it is my opinion that annual labor can be performed on the south fork of the Clearwater highway, because the construction of this road will 'facilitate the extraction of metals' in all the mines within the district."

While we agree with Inspector Campbell as to the propriety of crediting annual assessment work with work performed on roads, a legal question is involved, in that this road is designated as a "trunk line," which in turn is a public highway. The court decisions quoted by Mr. Campbell relate to "constructing a wagon road thereto" (meaning the claim); "for the purpose of developing such claim"; "to facilitate the extraction of metals"; and "to go outside of the boundaries of his claim and perform labor the purpose and effect of which was to aid in the development of his claim as a mine."

The evident object of assessment work is to develop an individual mining claim to a point where it appears feasible to convert it into a producing mine or abandon it. The object set forth in the association's resolution is a "trunk road." In this particular case a trunk road would undoubtedly help many small prospects by making

them accessible to modern transportation. If this diversion of work were permissible could not assessment work be devoted to the construction of a hydro-electric power plant, or other public utility? The question is a legal one, and one that will probably be ruled upon by the General Land Office when statements of assessment work are filed by these claim owners.

A Drifting Record?

WHAT CONSTITUTES A RECORD in tunneling or sinking is in general difficult to determine. Variables are many. The shafts or headings that are compared may differ in dimensions. Formations drilled are usually unlike in hardness and other physical characteristics. Even if in these major matters a fair comparison can be made, there may be other differences—in machines employed, the number of shifts and faces worked, the size of crew and its organization, and the method of mucking used. It is indeed a difficult task to compare and correlate the performances on such work. For this reason the footage made in a given number of working shifts is generally taken as the basis of comparison. This is convenient but hardly accurate. At the same time no better way appears.

Remarkable work was done in Washington this past October by the contractors driving the new 8-mile Cascade tunnel for the Great Northern Railway. The advance made in the month was 1,157 ft. The rock is granite, the heading 8 by 9 ft. in cross-section, and work was conducted only in one face. A. Guthrie & Co., of St. Paul, Minn., were the contractors. They claim this footage is a record. It surely is a great achievement.

Lodes and Apexes

ONE OF THOSE CURIOUS MONUMENTS to legal and professional stupidity and cupidity, an apex suit, is again to the fore in Butte, where the Clark and the Anaconda interests are matching their wits in another of the old legal feuds, in an issue involving $6,000,000 or more. The Clark interests assert the ownership of the apex of certain ores which have been stoped and are being stoped by the Anaconda company in an Anaconda claim called the Badger: they assert that the apex of this ore is in a claim called the Poser, and belonging to them.

"Distinguished geologists" and mining engineers testified valiantly on both sides: on the side of the Clark interests that this Poser vein exists—and on the part of the Anaconda interests that the Poser vein has no existence. On one side of the warring field was the University of California, for example; on the other side stood Yale, with a whole wide continent of difference of geological opinion between. The West Coast testified that there was a lode; the East Coast testified that there was not. The presentation of the argument has been continued till after the first of the year.

"One of the official stenographers," says an Anaconda (Mont.) paper, "is now in the hospital as a result of over-strain."

Nonsensical as these suits are, they are inevitable under the existing mining laws, which vest the sole title to ore in the possessor of outcropping lodes, which under certain established rules of the legal game lead downward to the valuable ore in depth. The laws being as they are, the legal rules and quibbles become necessary. Even the differences in geological opinion are admissible, for the question as to when a lode is not a lode would require long to argue. The unfortunate thing for the engineering and geological profession is that these differences are advertised and exploited; differences are hardened rather than harmonized, and at so much per day, and thus the precious scientific equity of judgment is unavoidably dulled.

This cannot be construed necessarily as a reflection against any attorney or witness involved. Do not doctors, as well as scientists, honestly disagree, and even the clergy quarrel sincerely? To be sure, there is a shade of difference between quarreling for pleasure and for profit. It is the nuance which separates the amateur from the professional: the difference between Red Grange the college ice-man, and Grange the salaried public player; between the temperamental amateur Suzanne Lenglen and Suzanne the ingratiating signer of a fat contract; between Bryan at a national Democratic convention and Bryan extolling Florida real estate. Nevertheless, what criticism there is should go to the system. It is the system which is responsible for all the consequent evils, including the wrecking of the stenographer's health and the frequent miscarriage of justice, which is blinded beyond hope by the continued presentation of opposed and biased views and selected data.

Competent Advice Needed

CERTAINLY there is no dearth of mining engineers of ability, nor do most of them ask extortionate sums for their services. Some of the well-known men, of course, demand fees that a small and struggling company would find it difficult to pay, but there are plenty of younger men who have topped their college training with a few years of experience and who would be glad to exchange their services for a few hundred dollars a month. Many such occupy teaching positions in our mining schools, and are free for many weeks in the year. And yet, all too often, the small mining company feels that expense for such expert advice is not warranted. Its directors, many of whom are probably small-caliber business and professional men with little or no experience in mining, feel that they have an attractive prospect, with the ore showing, and that a good practical miner or two can supervise digging it out. They shy away from the "expert," who, they think, would demand a fancy price for what might not be a too intelligent guess at best.

These thoughts are occasioned by an item in the last issue of our valued contemporary *Mining Truth*. "At a special meeting of the board of directors of Cynide Gold Mining Co.," it reads, "it was decided to raise funds for hiring a competent mining engineer. . . ." Now, this company was organized seven years ago to develop claims in Idaho. Considerable underground work has been done, an aërial tramway built, and a 200-ton cyanide mill constructed. Lastly, apparently, a competent mining engineer is to be engaged, and we sincerely hope he can produce the ore. The mine for a time was thought to contain platinum, the ore showing a high content of that metal when assayed by some of the notorious platinum assayers whose lack of professional ability was later exposed by governmental agencies.

Apparently, the Cynide Gold Mining Co. has suffered considerably from lack of expert advice. In the first place, a competent stenographer who was a good speller might have been employed, it would seem, to make out the incorporation papers; secondly, the proper type of

assayer, had one been employed, would have prevented any disillusions among the stockholders regarding platinum; and lastly, had a good mining engineer been "hired" in the first place, the company might have been paying dividends by now, or else closed down with no further expense. One might suggest that the directors now go a step further and *employ* a good engineer instead of *hiring* one, in view of Webster's definition that "*employ* is used to emphasize the idea of service to be rendered; *hire*, of wages to be paid; as to *employ* an expert accountant, to *hire* a drayman."

Julian Merger Mines, Inc.

"STRONGER THAN HORSE RADISH" is the title of an advertisement appearing in the *Los Angeles Express*, Oct. 12, 1926, in which one C. C. Julian is telling the public why he is willing that it should share the profits that are sure to accrue to the Julian Merger Mines, Inc. The opening sentence in this advertisement is, "You tell 'em, cowboy, to let 'er buck, and see if I care," which certainly will not appeal to any experienced mining man who may have money to invest. However, the appeal is not intended for this class. The advertisement does not even tell where the property is, save that the Cascade Consolidated and Blue Bell Silver are in British Columbia and Monte Cristo is in Arizona. He tells how he could have financed and developed each of these properties without disposing of a single share of stock. He then asks, "Why let the public in on such a plum?" "I am going to tell you why, but even while I am telling you the whole truth, I don't expect a single reader to believe me, because even I, as I write this, must admit it sounds fishy, but be that as it may, I am going to tell you anyway."

He recites how he secured control of the properties, how he selected his directors, six of the nine being expert mining engineers (no names given), and how he could have made $1,500,000 by selling one of the properties. But, no; he could not be selfish. He thought of the dear friends (the public) in Southern California, of how loyal they had been in winning battles for him during the past six years, and then "I thought of the times you had won on me, and I thought of the times you have lost on me, and I tried to make it balance, but I couldn't, I couldn't satisfy my conscience to pass you by, after all your kindness to me, on what I know better than anyone, is the only real legitimate opportunity to make something worth while that I have had to offer you in these six years. Was I going to let you in on all the gambles and when a cinch came along, hog it all for myself? I couldn't do it, folks, and that's the story, whether you believe it or not."

Whether the mining properties are good remains to be seen. The Monte Cristo mine has been under development for a number of years and is reported to have a shaft 1,100 ft. deep and possibly 6,000 ft. of development work. The question at issue is the methods of promotion by flamboyant and extravagant statements that may be misleading. To the man who knows, they do not appeal, but to that part of the public that is imbued with a gambling instinct and lacks knowledge of mining, such advertisements sink deep and ruin many. This opportunity to invest, the opportunity that comes only once in a lifetime, is set forth by the same C. C. Julian, who a few months ago sponsored Western Lead which was subjected to an investigation by the California authorities. The California "blue-sky" law may in some instances work a hardship, but such advertisements indicate that the law might be further strengthened in the interest of legitimate mining and for the protection of the investing public.

Forced Recovery of Petroleum

INVOLVED in the question of better use of petroleum resources is the matter of securing a greater recovery from the pools already known. A large percentage of the oil originally in a pool remains in the ground after pumping has ceased to have effect. Estimates of this per cent place it as high as 85 and 90. Methods of forced recovery to win any part of the oil that pumping cannot raise are therefore of considerable importance. Principal among these are the water flooding and the compressed-air processes.

Figures showing how compressed air has increased recovery at the Elliott pool, near Nowata, Okla., in the last two years are given in a Bureau of Mines report (No. 2778) by B. E. Lindsly. This pool covers about 540 acres. Between 1909, when the first well was drilled, and 1923, by which time 111 had been put down, a total production of about 1,800,000 bbl. had been made, a figure based on pipe-line runs. According to Mr. Lindsly's estimate 91 per cent of the oil originally in the ground was still there at the beginning of 1924.

Pressure was put on the pool in July, 1924, after preparations had been made. Six wells were used in doing this. The pressure was partly supplied by returning the casinghead gas down the wells. This, some 485,000 cu.ft. per day, was insufficient, so air to the extent of 563,000 cu.ft. was added daily. Inasmuch as this air and gas formed an explosive combination, exhaust gas was later substituted for the air in the mixture delivered by the compressors to the field.

As a result of all this effort the daily output of the pool increased from 48.6 bbl. to 165.5 bbl., or approximately 240 per cent. The Elliott pool is small and its production unimportant, but the result of the experiment suggests what can be done on pools of larger size.

Abroad as well as in the United States the problem of increasing the recovery of petroleum is being studied. In Germany the Academy at Clausthal has just invited petroleum operators to co-operate with it in attempting to solve a similar problem. There the recovery is little better than at the Elliott pool.

Making Industry Noiseless

NOW that the Maxim silencer has been applied to the oil-electric locomotive to effect its noiseless operation, perhaps some genius will devise a way of robbing the stamp mill of its thunder. Or is this to be accomplished by the passing of the stamp? Surely it is too much to hope that the air drill can be muffled, and that dynamite can possibly be separated from its bang. Noise of sorts seems to be the miner's portion. Here, though, has been a great improvement. For example, steam engines exhausting into atmosphere, which once were rather common, are rarely found today. Now motors take their place or drive them, not for the sake of noiselessness but for the other advantages that electrification has.

Noiselessness is worth an effort. Unnecessary noise means waste and perhaps accidents. Besides, it pays to go easy on the nerves, a truth often overlooked.

Storing Commercial Explosives

Selecting Site for Magazine—Design and Materials to Be Used in Building—Ventilation—Proofing Against Weather and Fire

By Edwin B. Jones
Wilmington, Del.

Edwin B. Jones

EXPLOSIVES, as well as many other commodities in daily use, require that certain common-sense rules be followed and precautions taken, to insure safety to the public as well as the most satisfactory results for the user. One of these precautions is suitable safe storage. No one will seriously question the necessity for safe storage, any more than one would question the necessity of keeping lighted matches or fire from gas or gasoline, benzine or naphtha.

Storage may be safe but absolutely unsuitable or it may be suitable for protecting explosives but absolutely unsafe. Safe storage may be defined as the storing or keeping of explosives in a place where, if they explode, no serious injury can occur to persons or property. Any other storage would be unsafe.

What constitutes suitable storage is not a question of individual opinion, but is something that depends upon fundamental characteristics of the explosives and years of experience. It may be defined as protection from moisture, the weather, fire, excessive heat, theft, unauthorized persons and in case of commercial high explosives from being shot into. Any other method of storage or keeping explosives would be unsuitable and might be unsafe. Violation of proper safety rules in the operation of a magazine, fire, or a rifle bullet, if high explosives are stored, may cause a magazine explosion.

When a new magazine is to be built the questions likely to arise are: (1) Where should it be located? (2) What size should it be built? (3) What materials should be used and how should it be constructed?

Where Should Magazine Be Located?

The character of ground or terrain on which a magazine may be located will depend upon the geological formation and topography of the section in which it is to be built. Where it is possible, experience has

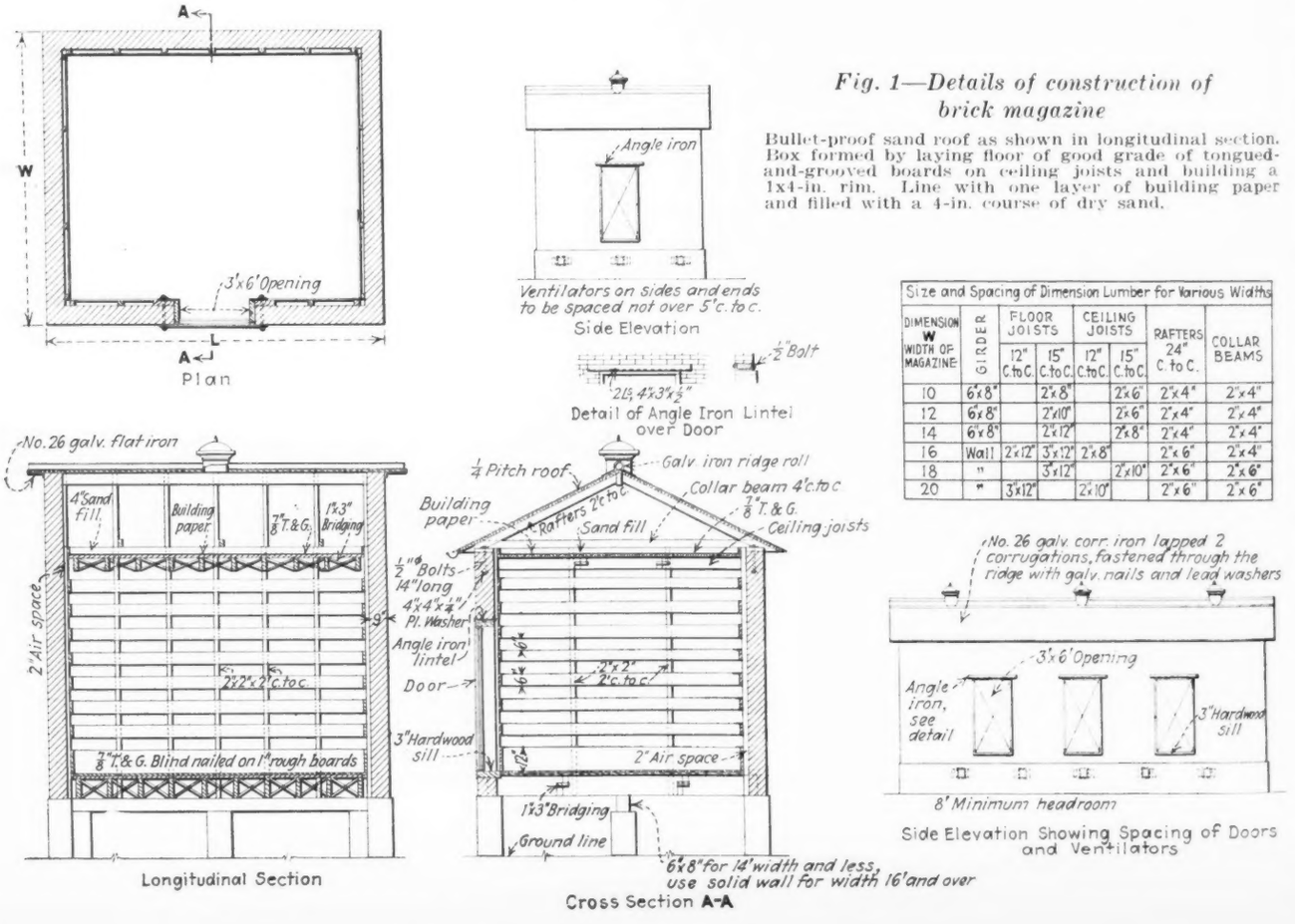

A
W
3'x6' Opening
L
A
Plan
Angle iron
Ventilators on sides and ends to be spaced not over 5' c. to c.
Side Elevation
2L's 4"x3"x 5/16"
1/2" Bolt
Detail of Angle Iron Lintel over Door
No. 26 galv. flat iron
4" Sand fill
Building paper
7/8" T. & G.
1"x3" Bridging
2' Air space
2"x2"x2' c. to c.
7/8" T. & G. Blind nailed on 1" rough boards
Longitudinal Section
1/4 Pitch roof
Galv. iron ridge roll
Collar beam 4' c. to c.
Building paper
Rafters 2' c. to c.
Sand fill
7/8" T. & G. Ceiling joists
1/2" Bolts 14" long
4"x4"x1/4" Pl. Washer
Angle iron lintel
Door
2"x2" 2' c. to c.
3" Hardwood sill
2' Air space
1"x3" Bridging
Ground line
6"x8" for 14' width and less, use solid wall for width 16' and over
Cross Section A-A
No. 26 galv. corr. iron lapped 2 corrugations, fastened through the ridge with galv. nails and lead washers
3'x6' Opening
Angle iron, see detail
3" Hardwood sill
8' Minimum headroom
Side Elevation Showing Spacing of Doors and Ventilators

Fig. 1—Details of construction of brick magazine

Bullet-proof sand roof as shown in longitudinal section. Box formed by laying floor of good grade of tongued-and-grooved boards on ceiling joists and building a 1x4-in. rim. Line with one layer of building paper and filled with a 4-in. course of dry sand.

Size and Spacing of Dimension Lumber for Various Widths

DIMENSION W WIDTH OF MAGAZINE	GIRDER	FLOOR JOISTS 12" C. to C.	FLOOR JOISTS 15" C. to C.	CEILING JOISTS 12" C. to C.	CEILING JOISTS 15" C. to C.	RAFTERS 24" C. to C.	COLLAR BEAMS
10	6"x8"		2"x8"		2"x6"	2"x4"	2"x4"
12	6"x8"		2"x10"		2"x6"	2"x4"	2"x4"
14	6"x8"		2"x12"		2"x8"	2"x4"	2"x4"
16	Wall	2"x12"	3"x12"	2"x8"		2"x6"	2"x4"
18	"		3"x12"		2"x10"	2"x6"	2"x6"
20	"	3"x12"		2"x10"		2"x6"	2"x6"

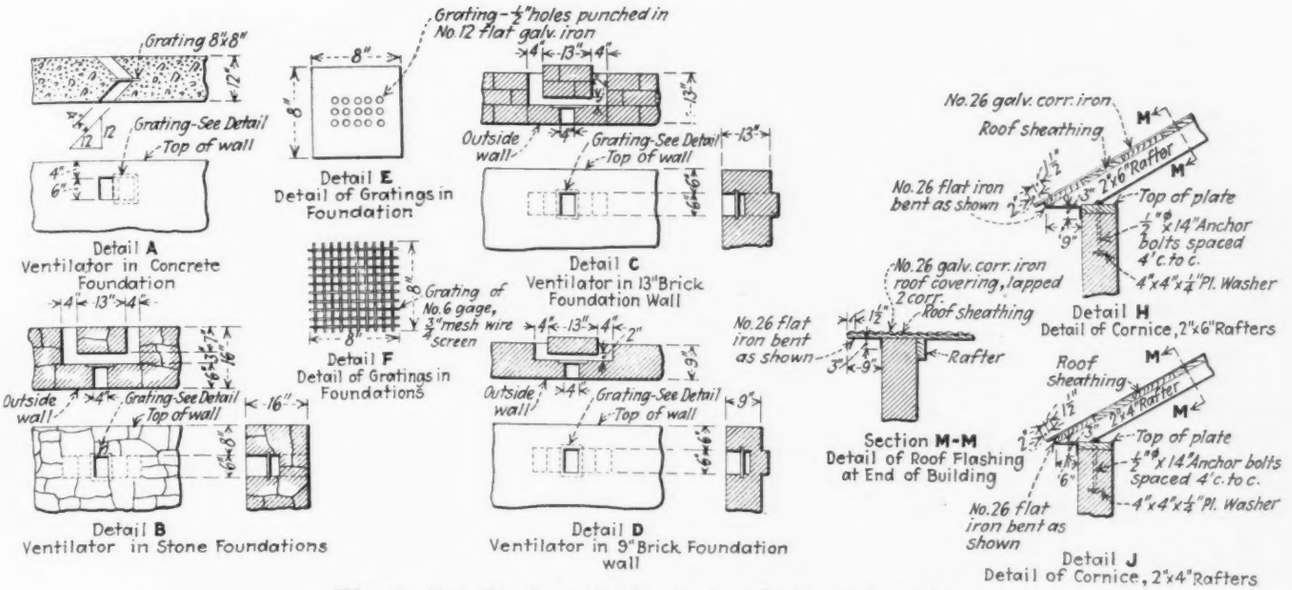


Fig. 2—Details of ventilation in foundation and cornice

shown the great advantage of utilizing the topography and natural features of the ground (such as dense timber) for barricades or protection. It is not the best practice to locate a magazine on top of the highest hill in the locality, because it would be more likely to be struck by lightning, and should it explode, even though it be artificially barricaded, the force of the explosion might affect a greater radius than if the magazine was located where the topography or artificial barricades afforded better protection to objects in the vicinity.

In some states the location of a magazine is regulated by laws and regulations (in cities by ordinances)

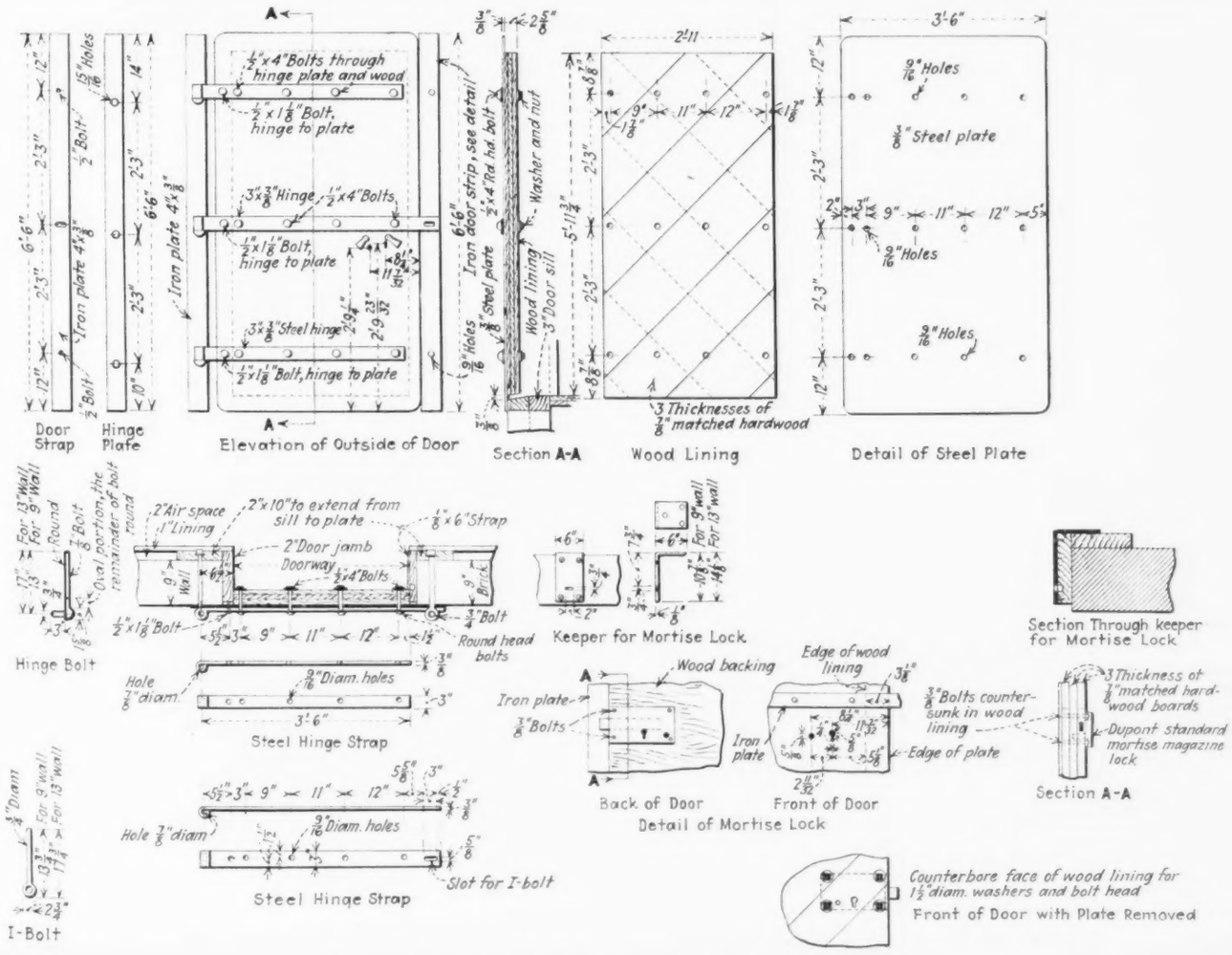


Fig. 3—Details of bullet-proof door for brick magazine

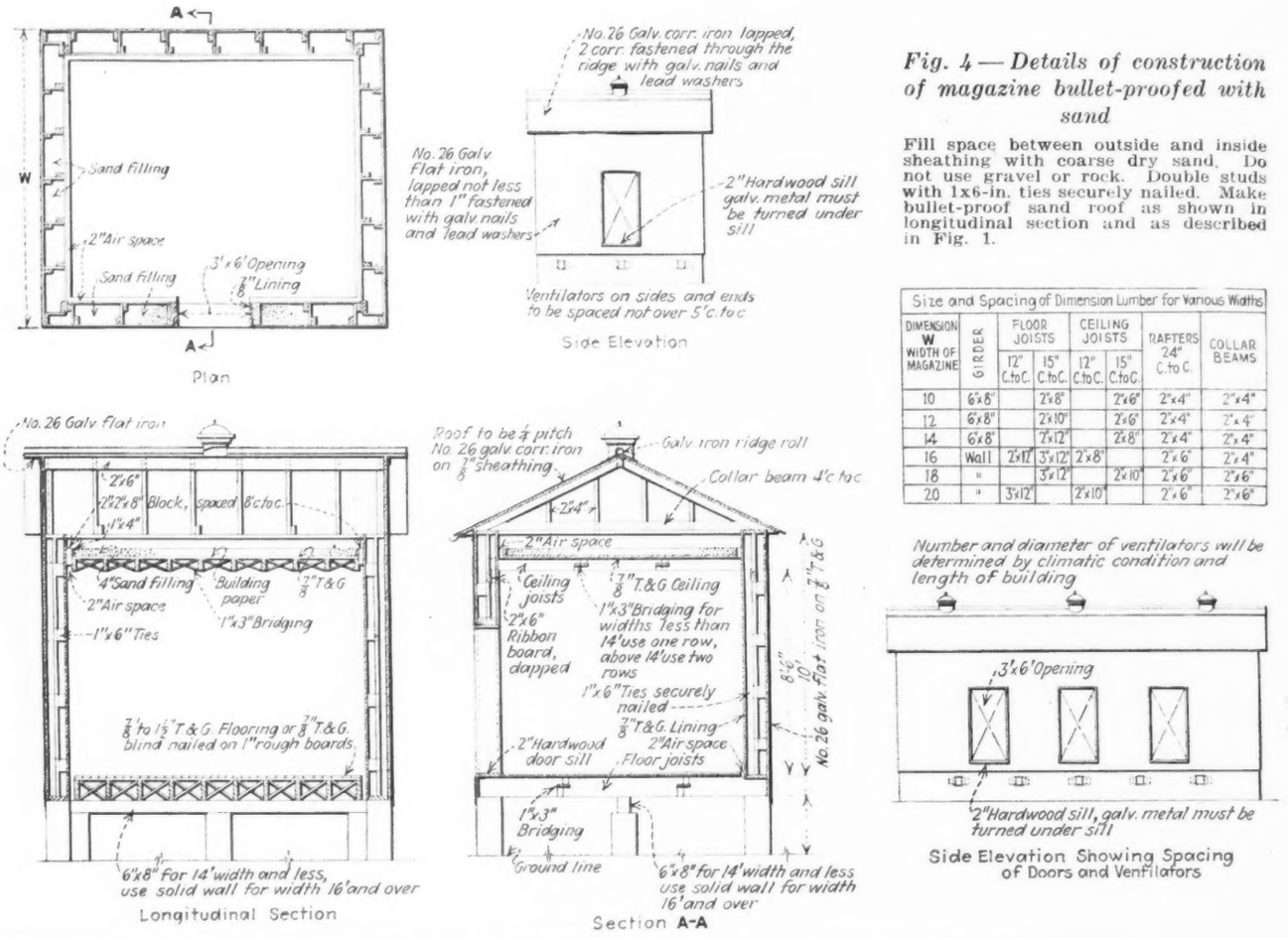

A
W
Sand filling
2"Air space
Sand filling
3'x6'Opening
⅞"Lining
A
Plan
No.26 Galv. corr. iron lapped, 2 corr. fastened through the ridge with galv. nails and lead washers
No.26 Galv. Flat iron, lapped not less than 1" fastened with galv. nails and lead washers
2"Hardwood sill galv. metal must be turned under sill
Ventilators on sides and ends to be spaced not over 5'c. to c.
Side Elevation
No.26 Galv. Flat iron
2"x6"
2"x4"x8" Block, spaced 8'c. to c.
1"x4"
4"Sand filling
Building paper
⅞"T&G
2"Air space
1"x3"Bridging
1"x6"Ties
⅞ to 1½"T.&G. Flooring or ⅞"T.&G. blind nailed on 1"rough boards.
6"x8" For 14'width and less, use solid wall for width 16'and over
Longitudinal Section
Roof to be ¼ pitch
No.26 galv. corr. iron on ⅞"sheathing
Galv. iron ridge roll
Collar beam 4'c. to c.
2"x4"
2"Air space
Ceiling joists
2"x6" Ribbon board, dapped
⅞"T.&G. Ceiling
1"x3"Bridging for widths less than 14'use one row, above 14'use two rows
1"x6"Ties securely nailed
⅞"T.&G. Lining
2"Air space
Floor joists
2"Hardwood door sill
1"x3" Bridging
Ground line
6"x8" For 14'width and less use solid wall for width 16'and over
Section A-A
8'6"
10'
No.26 galv. flat iron on ⅞"T&G
Number and diameter of ventilators will be determined by climatic condition and length of building
3'x6'Opening
2"Hardwood sill, galv. metal must be turned under sill
Side Elevation Showing Spacing of Doors and Ventilators

Fig. 4 — Details of construction of magazine bullet-proofed with sand

Fill space between outside and inside sheathing with coarse dry sand. Do not use gravel or rock. Double studs with 1x6-in. ties securely nailed. Make bullet-proof sand roof as shown in longitudinal section and as described in Fig. 1.

Size and Spacing of Dimension Lumber for Various Widths

DIMENSION W WIDTH OF MAGAZINE	GIRDER	FLOOR JOISTS 12" C.to C.	FLOOR JOISTS 15" C.to C.	CEILING JOISTS 12" C.to C.	CEILING JOISTS 15" C.to C.	RAFTERS 24" C.to C.	COLLAR BEAMS
10	6"x8"		2"x8"		2"x6"	2"x4"	2"x4"
12	6"x8"		2"x10"		2"x6"	2"x4"	2"x4"
14	6"x8"		2"x12"		2"x8"	2"x4"	2"x4"
16	Wall	2"x12"	3"x12"	2"x8"		2"x6"	2"x4"
18	"		3"x12"		2"x10"	2"x6"	2"x6"
20	"	3"x12"		2"x10"		2"x6"	2"x6"

and storage provided in such states should conform to state laws or local requirements. Where no such laws or regulations exist, it is recommended that magazines be located in compliance with the American Table of Distances, which specifies the amount of explosives that may safely be stored at various distances from inhabitated buildings, railroads and public highways.

The distances in the Table of Distances are usually shown on a barricaded basis, in which case they should be doubled when inhabited buildings, railroads or public highways are not effectually screened from the magazine either by the natural features of the ground or by an efficient artificial barricade. This barricade should be of such height that a straight line drawn from the top of any side wall of the magazine to any part of the inhabited building to be protected or to any point 12 ft. above the center of the railroad or highway to be protected, will pass through such intervening natural or artificial barricade. An efficient artificial barricade means an artificial mound or properly revetted mound of earth of a thickness of not less than 3 ft.

Partial Protection Not Sufficient

In building barricades it is important not to use stone, gravel or other material that might become missiles should there be an explosion in the magazine, and to erect them so there will be sufficient space to get around conveniently between the magazine and barricade. A magazine is either protected or unprotected from surrounding objects—partial protection is not sufficient protection.

American Table of Distances

—Blasting and Electric Blasting Caps— Number Over	Number Not Over	—Other Exposives— Pounds Over	Pounds Not Over	Inhabited Buildings Barricaded(a) (Feet)	Public Railway Barricaded(a) (Feet)	Public Highway Barricaded(a) (Feet)
1,000	5,000	.....	.....	15	10	5
5,000	10,000	.....	.....	30	20	10
10,000	20,000	.....	.....	60	35	18
20,000	25,000	.....	50	73	45	23
25,000	50,000	50	100	120	70	35
50,000	100,000	100	200	180	110	55
100,000	150,000	200	300	260	155	75
150,000	200,000	300	400	320	190	95
200,000	250,000	400	500	360	215	110
250,000	300,000	500	600	400	240	120
300,000	350,000	600	700	430	260	130
350,000	400 000	700	800	460	275	140
400,000	450,000	800	900	490	295	150
450,000	500,000	900	1,000	510	305	155
500,000	750,000	1,000	1,500	530	320	160
750,000	1,000,000	1,500	2,000	600	360	180
1,000,000	1,500,000	2,000	3,000	650	390	195
1,500,000	2,000,000	3,000	4,000	710	425	210
2,000,000	2,500,000	4,000	5,000	750	450	225
2,500,000	3,000,000	5,000	6,000	780	470	235
3,000,000	3,500,000	6,000	7,000	805	485	245
3,500,000	4,000,000	7,000	8,000	830	500	250
4,000,000	4,500,000	8,000	9,000	850	510	255
4,500,000	5,000,000	9,000	10,000	870	520	260
5,000,000	7,500,000	10,000	15,000	890	535	265
7,500,000	10,000,000	15,000	20,000	975	585	290
10,000,000	12,500,000	20,000	25,000	1,055	635	315
12,500,000	15,000,000	25,000	30,000	1,130	680	340
15,000,000	17,500,000	30,000	35,000	1,205	725	360
17,500,000	20,000,000	35,000	40,000	1,275	765	380
.....	.....	40,000	45,000	1,340	805	400
.....	.....	45,000	50,000	1,400	840	420
.....	.....	50,000	55,000	1,460	875	440
.....	.....	55,000	60,000	1,515	910	455
.....	.....	60,000	65,000	1,565	940	470
.....	.....	65,000	70,000	1,610	970	485
.....	.....	70,000	75,000	1,655	995	500
.....	.....	75,000	80,000	1,695	1,020	510
.....	.....	80,000	85,000	1,730	1,040	520
.....	.....	85,000	90,000	1,760	1,060	530
.....	.....	90,000	95,000	1,790	1,075	540
.....	.....	95,000	100,000	1,815	1,090	545
.....	.....	100,000	125,000	1,835	1,100	550
.....	.....	125,000	150,000	1,900	1,140	570
.....	.....	150,000	175,000	1,965	1,180	590
.....	.....	175,000	200,000	2,030	1,220	610
.....	.....	200,000	225,000	2,095	1,260	630
.....	.....	225,000	250,000	2,155	1,295	650

(a) Barricaded, as here used, signifies that the building containing explosives is screened from other buildings, railways, or from highways by either natural or artificial barriers. Where such barriers do not exist, the distances should be doubled.

It may sometimes be found impossible to provide the necessary storage in one magazine and comply with the Table of Distances or the state law. In such cases, two or more magazines may be built to reduce the amount stored in each to conform to the table or the state law.

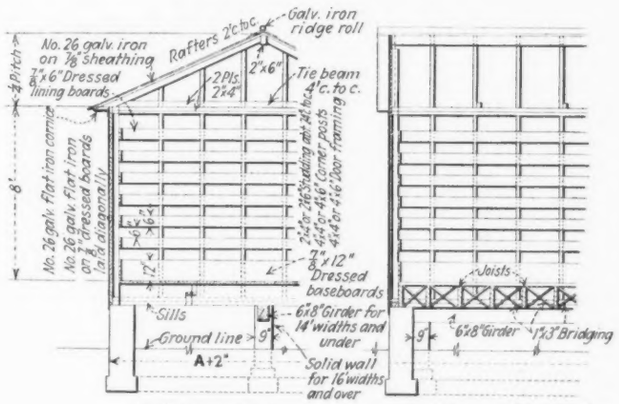
If more than one magazine is built in the same location the following rule should be used for their separation: Each magazine containing more than 5,000 lb. of explosives should be located at least 200 ft. apart from any other magazine, and where more than 25,000 lb. of explosives is to be stored in a magazine, the distance between magazines, 200 ft., should be increased $2\frac{2}{3}$ ft. for each additional 1,000 lb. over 25,000 lb. to be stored in the magazine. If the magazines are effectually protected one from the other by natural or artificial barricades, the distance between them may be reduced one-half.

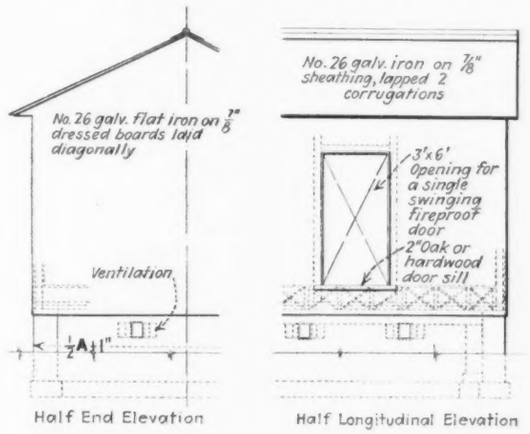
Determining Inside Area

Knowing the amount and kind of explosives to be stored, the inside area of a magazine can be determined by the following formula:

$$A = \frac{C}{H} \times \frac{S}{F}$$

A = Inside area in square feet.


Galv. iron ridge roll
No. 26 galv. iron on ⅞" sheathing
Rafters 2' c. to c.
7/8"x6" Dressed lining boards
2 Pcs 2"x4"
2"x6"
Tie beam 4' c. to c.
No. 26 galv. flat iron cornice
No. 26 galv. flat iron on ⅞" dressed boards laid diagonally
2"x6" 26" studding set 4' c. to c.
2"x4" Corner posts
4"x6" or 4"x8" Door framing
7/8"x12" Dressed baseboards
Sills
Ground line
A+2"
6"x8" Girder for 14' widths and under
Solid wall for 16' widths and over
Joists
6"x8" Girder
1"x3" Bridging
Half Cross Section
Half Longitudinal Section


No. 26 galv. flat iron on ⅞" dressed boards laid diagonally
Ventilation
½A±1'
No. 26 galv. iron on ⅞" sheathing, lapped 2 corrugations
3'x6' Opening for a single swinging fireproof door
2" Oak or hardwood door sill
Half End Elevation
Half Longitudinal Elevation

A	Girder	Floor Joists 12" C. to C.	Floor Joists 15" C. to C.	Rafter 2' C. to C.	Collar Beams
10	6"x8"		2"x8"	2"x4"	2"x4"
12	6"x8"		2"x10"	2"x4"	2"x4"
14	6"x8"		2"x12"	2"x4"	2"x4"
16	Wall	2"x12"	3"x12"	2"x6"	2"x4"
18	"		3"x12"	2"x6"	2"x6"
20	"	3"x12"		2"x6"	2"x6"

A Denotes width of magazine

A	Plates, Sills, Studs: Magazine under 30' Length	Plates, Sills, Studs: Magazine over 30' length
10	2"x4"	
12	2"x4"	
14	2"x4"	
16	2"x4"	2"x6"
18	2"x6"	2"x6"
20	2"x6"	2"x6"

Fig. 5—Details of powder magazine construction

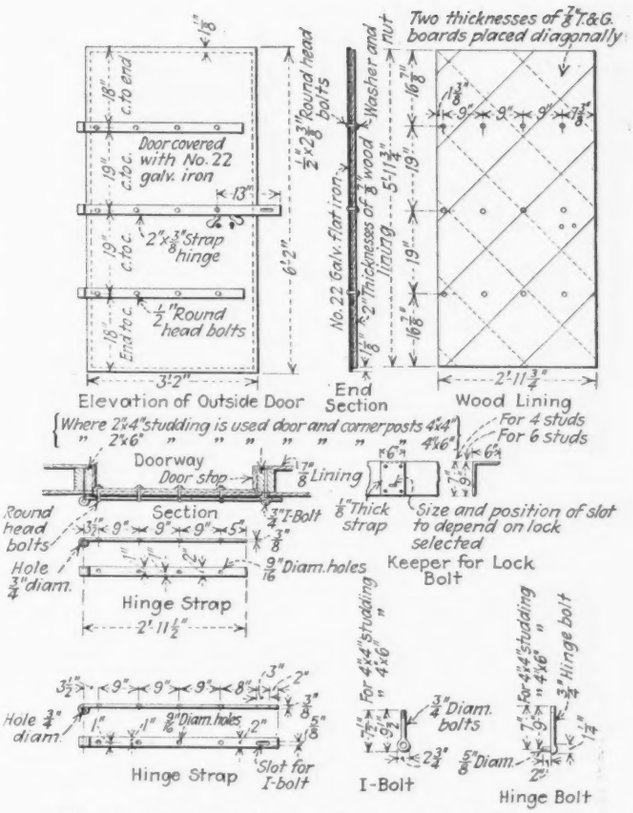


Fig. 6—Construction of fire-protected door for powder magazine

C = Number of cases or packages to be stored.

F = Ratio of floor space used for storage to the entire floor space. This is usually from 60 to 70 per cent, depending on the aisle space desired.

H = Number of cases high the explosives are to be piled.

L = Inside length in feet.

W = Inside width in feet.

S = Square feet of floor space one case or package occupied.

After determining the inside area, it is usual to decide the width or length for a magazine. The other inside dimension in feet may be determined by $L = \frac{A}{W}$ or $W = \frac{A}{L}$, to which should be added the thickness of the walls and lining to obtain the necessary outside dimensions. For brick magazines it is usual to add 2 ft. to the inside dimensions.

Construction Materials Should Be Carefully Selected

A magazine should be constructed of the material that will properly protect the explosives to be stored and that will not become dangerous missiles should there be an explosion. For permanent storage for high explosives, a magazine built of medium soft bricks that will resist weather conditions is the best. For temporary storage magazines, wood covered with galvanized iron and bullet-proofed with sand, if high explosives are to be stored, will be found satisfactory.

Years of experience have proven that stone and concrete are not the most suitable materials for magazine

construction for commercial explosives, nor have a number of other materials used for this purpose proven invariably satisfactory.

For the storage of high explosives the magazine should be bullet- and weather-proof, fire-protected and

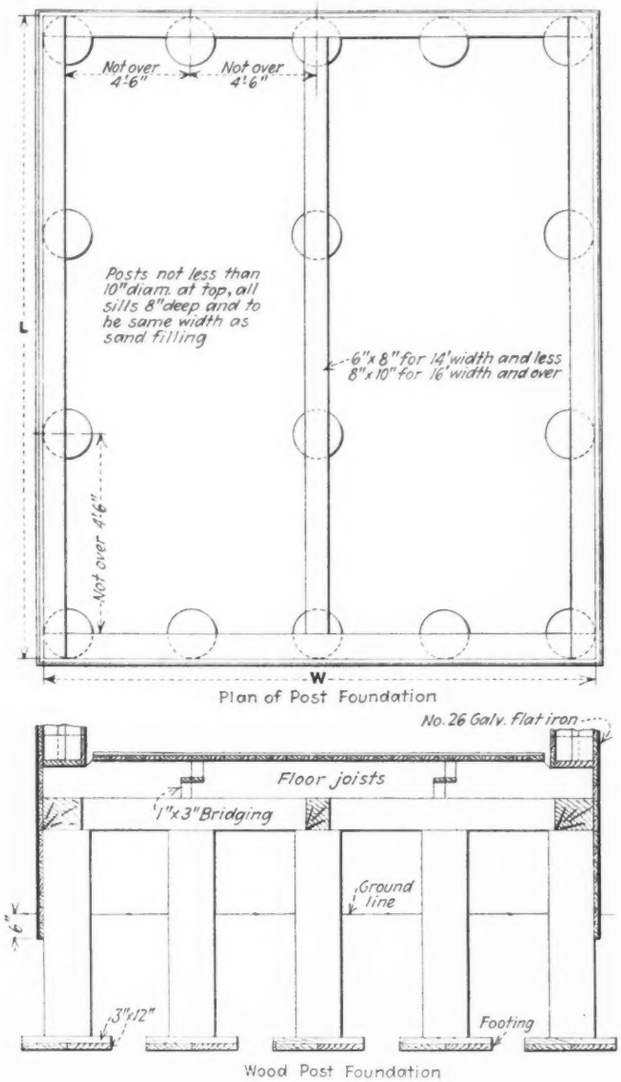


Fig. 7—Construction details of post foundation for temporary magazine

sufficiently ventilated to protect the explosives properly in the specific locality. The foundation for such a magazine may be brick, concrete or stone, and the magazine walls above the top of foundation or floor level should be of medium-soft brick, that will resist weather conditions, laid in cement mortar containing not more than 25 per cent lime.

The roof should be of wood frame and sheathing, covered with corrugated galvanized iron secured with galvanized nails and lead washers or tin, and all woodwork on outside of the magazine fire protected with not less than No. 26 gage flat galvanized iron. If the roof can be shot into, it should be bullet-proofed with sand. See Fig. 1. If the roof cannot be shot into, it should be ceiled to keep the magazine cool.

Sufficient ventilation in the foundation and roof should be provided to protect the explosives properly in the specific locality. See Fig. 2.

The floor, except in front of the door, and the bullet-proof sand box or ceiling should be set back at least 2 in. from the brick walls for ventilation. See Fig. 1.

The bullet-proof door should consist of not less than three thicknesses of $\frac{7}{8}$-in. matched hardwood boards, covered on the outside with a $\frac{3}{8}$-in. steel plate. See Fig. 3. Similar doors are recommended for a temporary high explosive magazine, except that the steel door plate is only 3 ft. $3\frac{1}{2}$ in. wide, and the iron plates on each side fit close to it, and are only 3 in. wide.

Constructing a Temporary Magazine

For a temporary magazine, for high explosives, the magazine above the foundation may be sheathed outside and lined inside with not less than $\frac{7}{8}$-in. tongued-and-grooved boards, the intervening space between the inner and outer lining from the sill to the plate completely filled with dry, sharp sand well tamped in. The thickness of the sand bullet-proofing should vary from 6 in. to 12 in., depending upon the caliber of rifle and kind of ammunition used in the locality. See Fig. 4.

The outside of the building should be fire-protected with not less than No. 26 gage galvanized iron, firmly secured to the building with galvanized nails and lead washers.

The construction of the roof, the fire and weather protection, the ventilation in roof and foundation and the floor and bullet-proof sand box or ceiling should be taken care of in the same way as in the case of brick magazines. See Figs. 1, 2 and 4.

Weather-proofing and Fire Protection

For the storage of black powder only, the magazine should be weather-proof and fire-protected. The foundation may be of brick, concrete or stone. Above the foundation the magazine may be of frame construction sheathed with wood on the outside and covered with not less than No. 26 gage galvanized iron firmly secured to the building with galvanized nails and lead washers. See Fig. 5.

The roof should be of wood frame and sheathing, covered with corrugated galvanized iron secured with galvanized nails and lead washers, and all woodwork on the outside of the magazine fire-protected with not less than No. 26 gage flat galvanized iron. Fig. 6 shows a black-powder magazine door.

Weather-proofing and Fire Protection

If the storage magazine is to be only temporary it may occasionally be found economical to use a post foundation. See Fig. 7. The outside sheathing and metal covering of the magazine should be extended about 6 in. into the ground for fire protection. Ventilation is provided by cutting holes about 6x6 in. in the sheathing, covering these with No. 6 gage $\frac{3}{4}$-in. mesh wire screen secured to the sheathing, and with cut or punched $\frac{3}{4}$-in. holes in the galvanized iron covering.

It is frequently necessary to store within city limits the daily supply of explosives for mining operations and construction work. If the local ordinance or regulations do not specify the type of construction, it is good practice to construct such a magazine, weather-proofed and fire-protected, painted a distinctive color and conspicuously marked on the outside to indicate the contents.

There seems to be no system of lightning protection that will give absolute protection to magazines. It is thought that no method of protecting against lightning is safer than many of the systems used.

As for thawing, it is not considered safe or good practice to use a surface storage magazine as a thawing house. The principal manufacturers of explosives have for years manufactured low-freezing explosives that have eliminated the necessity for thawing. Where other types of explosives are still used and thawing is necessary, except in the mines, a separate thawing house is recommended.

Fuse should be kept in a dry cool place.

The importance of securely locking a magazine to prevent the theft of explosives for unlawful purposes or their getting into the hands of children or unauthorized persons will surely be recognized. Experience indicates that a specially designed two-key mortise lock, securely bolted to the wood backing of the iron door plate and a lock keeper that cannot be broken with an ordinary jimmy, affords the greatest protection against theft of explosives.

Bad Practices

No article on the subject of storage of explosives would be complete unless attention was called to many recognized bad practices.

It is not good or safe practice to store blasting or electric blasting caps with other explosives, or to store dynamite in a powder magazine unless the magazine is bullet-proof; nor to store inflammable materials, oil, paints, carbide, metal, metal tools, machinery or any material except explosives in a magazine. Explosives should not be left, kept or stored where children, unauthorized persons or animals have access to them; where they are exposed to direct rays of the sun; or in dwellings, offices, barns, outhouses, boiler rooms, blacksmith or other shops, oil or tool houses and tool boxes.

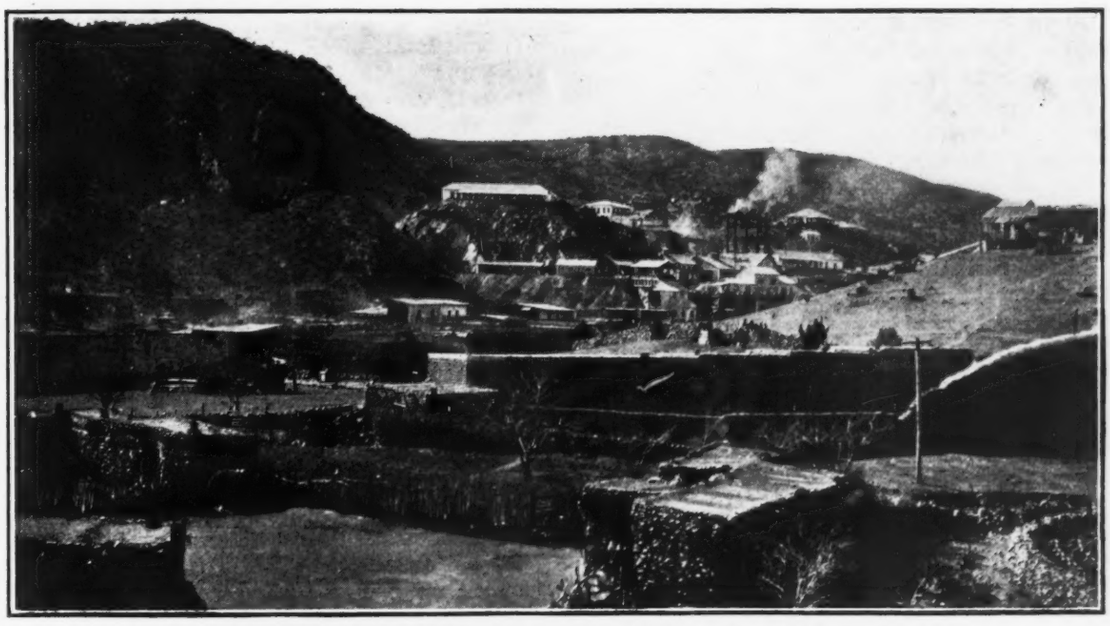
From observation, it is obvious that many explosive users do not obtain full dollar value from the explosives which they use because of improper storage, handling, use or loading.

Commercial explosives are hydroscopic and the absorption of moisture reduces their explosive efficiency. Explosives left, kept or stored where they can absorb any moisture will have "lowered efficiency," which means the loss of money value to the purchaser. Explosives stored or kept in a damp mine or under-ground tunnel magazine, left on damp ground or in the open, unprotected from moisture, rain or sun, or unprotected from the elements while being transported or in non-weather-proof magazines, will not give the most satisfactory results.

Keep Explosives from Children

The importance of protecting blasting caps and electric blasting caps so as to prevent children from obtaining them cannot be too forcibly impressed on the purchasers, handlers and users of explosives. Reports in the hands of explosives manufacturers indicate that from 300 to 500 innocent children yearly are permanently injured and maimed for life and some are killed by playing with blasting caps or electric blasting caps which they find. Children are not familiar with and do not know the great danger of playing or tampering with such explosives. It is not likely they could secure them if all persons having, owning, or using explosives would take proper precautions to prevent children obtaining them. Except when being used, explosives should be kept locked in a magazine and under no circumstance should they be left lying around or thrown away where children or others may find them and suffer serious injury or loss of life by playing with them.

All explosives manufacturers issue complete safety rules for the operation of explosives magazines and are always glad to supply their customers or others who need them.



Cusihuiriachic, Chihuahua, one of Mexico's gold camps

Phosphate Reserves Ample for 2,000 Years

Estimates of World Supply Show United States as Principal Source—Tunisia Second in Current Output

By George Rogers Mansfield
U. S. Geological Survey, Washington

THE PRINCIPAL TYPES of commercial phosphate deposits are residual, replacement, and sedimentary. The sedimentary type is on the whole the most important. There are three great phosphate fields, the Western American, the North African and the Russian, with many smaller, widely scattered sources. Only one of the great fields, the North African, is being developed to any extent as yet, and this field in 1924 supplied more than 3,500,000 metric tons, or nearly half of the world's total production. The remainder came principally from the Eastern fields of the United States and from oceanic islands.

The world's reserves of phosphate have been estimated at approximately 16,867,000,000 metric tons, of which more than 10,500,000,000 tons is believed to be of high grade, or to contain more than 58 per cent of tricalcium phosphate. These reserves include the Western American and North African fields, the oceanic islands, and Palestine. The Russian field, so far as known, is generally lower in grade than 58 per cent, though some of the material from its southern areas is of better quality, and the recently reported phosphates from the Murcia district in Spain are also of low grade. From the figures cited the world's supply of phosphate should last more than 2,000 years on the present basis of production, and it is so widely distributed as to be readily accessible to practically all nations.

Data Are from Many Sources

The figures for phosphate production given in this paper are in general those for 1924, as compiled by the Division of Mineral Statistics of the U. S. Bureau of Mines and by the Imperial Institute, Mineral Resources Department, Great Britain. Information relating to occurrences and reserves has come from many sources, including official government bureaus, consular reports, articles published by mining engineers and others, compiled under different auspices and with different standards of accuracy. It has not been practicable to designate them separately.

United States—The estimated phosphate reserves of the United States are shown in Table I.

Table I—Estimate of Phosphate Rock Reserves in the United States, Dec. 31, 1924

Metric Tons

	Estimated Quantity Available		Estimated Quantity Available
Eastern field:		Western field:	
Arkansas	20,320,000	Idaho	5,169,257,000
Florida	298,704,000	Montana	397,584,000
Kentucky	892,000	Utah	331,973,000
South Carolina	8,941,000	Wyoming	117,594,000
Tennessee	85,300,000		
	414,157,000		6,016,408,000
Grand total			6,430,565,000

Read before the round-table conference, Division of Mineral Resources, Institute of Politics, Williamstown, Mass., Aug. 13, 1926. Published by permission of the Director, U. S. Geological Survey.

Figures for the Western field are based largely upon instrumental surveys along the outcrop of phosphate beds and upon the estimates of tonnage used in classifying public lands. Of the total area of lands withdrawn, which amount to 2,269,055 acres, only 10 per cent has been classified. It is clear, therefore, that estimates for this field must be gradually and greatly enlarged as the work of classification progresses. Nevertheless, reconnaissance work in parts of the unclassified areas suggests that their phosphates may be relatively low in grade.

The Florida hard-rock phosphate, which is of the residual type, supplies the highest-grade rock mined in the United States, ranging from 76 to 80 per cent or more in tricalcium phosphate, but it constitutes only about 10,000,000 tons of the estimate for Florida in Table I.

The land pebble, which includes the remainder, is somewhat lower, with marketable grades ranging from 68 to 77 per cent. Tennessee rock is comparable with the Florida land pebble, and the Western rock thus far has averaged about 72 per cent as mined. Florida and Tennessee brown phosphates require expensive washing as a part of their treatment. Western rock does not require washing, but is mined by underground methods.

Florida District Biggest Contributor

The total phosphate production of the United States for 1925 was 3,481,819 long tons, of which Florida supplied 84.1 per cent, Tennessee and Kentucky 13.7 per cent, and the Western states 2.8 per cent. A small quantity of South Carolina rock was sold, probably from existing stocks.

The Florida field has the advantage of accessibility to both rail and ocean transportation. The Tennessee field is less favorably situated, but the Western field is remote from existing markets, though parts of it are accessible to transcontinental railroads.

North African Field—The North African field includes Egypt, Tunisia, Algeria, and Morocco. Such phosphates as are exploited are mainly of the sedimentary type and of generally similar character in each of the countries named, but the highest-grade material is from Morocco.

Egypt—In Egypt the phosphates of the Koseir and Safaga districts, near the Red Sea coast, are the most important. Some phosphate is also produced at Sibaia, near Keneh, on the Nile. Much of the Egyptian phosphate is of too low grade for export, but the mines about 20 miles inland from Port Safaga and those about 12 miles from Koseir yield rock that averages 65 to 70 per cent. The Safaga mines are controlled by an English company that ships largely to Japan. Deposits of phosphate near Koseir and at Sibaia are exploited by an Italian company that ships mainly to Italy. The Sibaian phosphate is exported through Alexandria, and the volume is therefore limited by river and canal navigation, as the amount of water is not

always sufficient to afford a means of transportation. Reserves of Egyptian phosphate have been estimated at 179,000,000 metric tons.

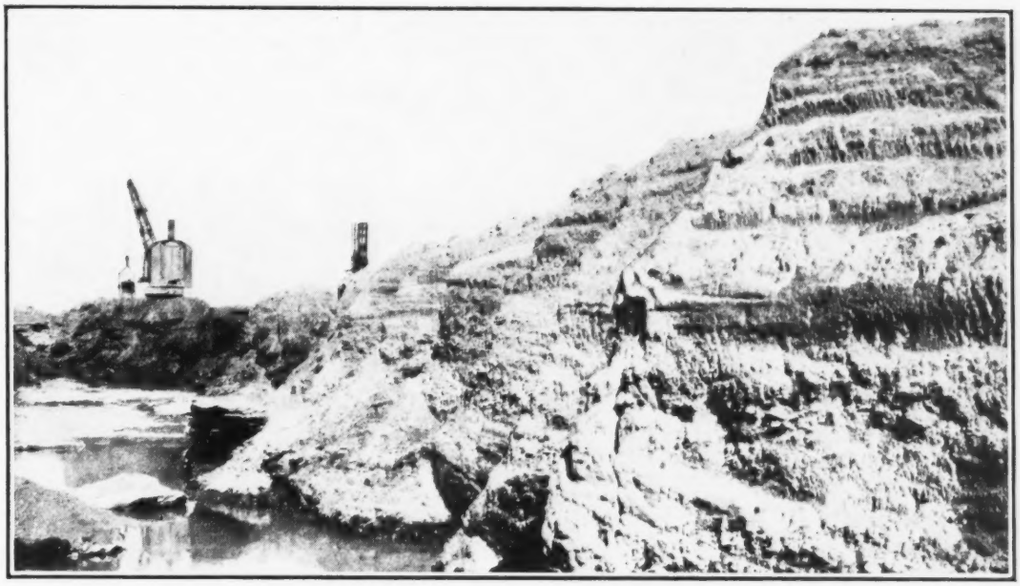
Tunisia—The principal deposits of phosphate rock in Tunisia are located in the southern part of the regency toward the Algerian border near Gafsa and to the southwest. The richest beds occur as lenses of great extent. In thickness, these lenses vary from a few inches to 10 ft. Only those deposits are worked that are near the railroad and that carry 58 to 68 per cent of tricalcium phosphate, the maximum grade. Practically all of the marketed phosphate falls in two grades, 58 to 63 per cent and 63 to 68 per cent. The moisture content averages about 4 per cent, and iron oxide and alumina are generally less than 2 per cent. The rock is very friable and is one of the type most easily converted into superphosphate. Owing to its soft character it is easily ground and readily worked.

The great phosphate mine at Gafsa contains four principal beds. By mixing the material from two beds 10 ft. and 6 ft. thick the product has an average of 60 per cent of tricalcium phosphate. Six companies were operating in 1924, with a combined production of 2,391,000 metric tons. In 1925, the production was 2,691,000 metric tons. The Société des Phosphates et du Chemin de Fer de Gafsa is the largest producer both in Tunisia and in the world. This company in 1924 produced 1,730,000 metric tons. Principal shipping ports are Sousse, Tunis, and Sfax. Phosphate reserves of Tunisia are variously estimated from 57,700,000 to 1,000,000,000 metric tons. The larger figure probably includes a large but undetermined amount of low-grade rock.

Algeria—Large deposits of sedimentary rock phosphate occur in Algeria similar to those of Tunisia. The two most important mining districts are near the towns of Setif and Tebessa, in the Department of Constantine, in the eastern part of the country.

Output Limited by Railroad Capacity

The most important deposits in Algeria are those at Djebel 'Kouif, near Tebessa, operated by the Companie des Phosphates de Constantine. In these the phosphate occurs in a basin-shaped deposit composed of five separate beds, three of which are workable. The thickness of the beds worked varies from 1¾ to 9 ft. When the overburden exceeds 24 ft. the rock is worked by inclined tunnels; otherwise open-cut methods are used. A branch railway, 16 miles long, connects the mine with the railway from Tebessa to the port of Bona, but this railway is capable of transporting only 330,000 tons of rock annually. The output from the mine is consequently controlled by railway facilities and not by the potential resources of the deposit. The average grade of the rock throughout the Tebessa district ranges from 58 to 68 per cent of tricalcium phosphate.



Reworking an old pit of Charleston, S. C., Mining & Manufacturing Co., Mt. Pleasant, Tenn.

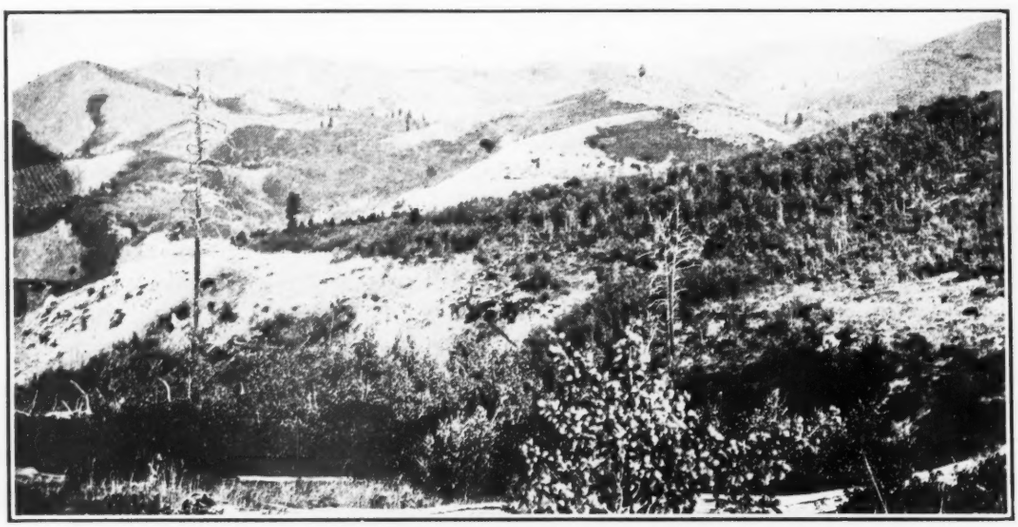
In the Setif district the rock is mined either by open cuts or by tunnels. The grade is 58 to 68 per cent of tricalcium phosphate. The rock is transported in some instances as far as 12 miles by ropeway to the railroad. In other parts of the district standard-gage branch lines connect with the East Algerian railway system. The distance from port is 190 km., or about 118 miles.

Several Virgin Deposits in Algeria

There are several known deposits of phosphate rock in Algeria which have not yet been worked. The principal one of these is Djebel Onk, about 50 miles south of Tebessa and 125 miles from the Algerian seacoast and only 3 or 4 miles from the Tunisian border. It has no transportation facilities, because the nature of the country to the north makes difficult and expensive any connection with railroads running to Algerian ports. On the other hand, the easier and less expensive outlet to Tunisian ports is opposed on nationalistic grounds. The deposit contains beds 30 to 60 m. thick, relatively free from silica or calcareous clay. Workable grades vary from 60 to 69 per cent of tricalcium phosphate, though some of it runs as high as 80 per cent. Only traces of iron and alumina are present. The absence of silica renders crushing easy and the absence of water makes drying unnecessary. From surveys which have been made the deposits are estimated to contain a minimum of 1,000,000,000 metric tons of high-

grade rock 60 to 70 per cent pure. Reserves of the Tebessa district have been estimated at 172,000,000 tons, and those of the other fields combined at 280,000,000 tons. These are doubtless liberal figures, but they make the approximated total for Algeria 1,452,000,000 tons.

Morocco—Phosphate of probably workable character is known to occur in three fairly large areas in the northwestern coastal region of Morocco. Of these, the northernmost, which is the only one explored in any detail or worked, is about 80 miles southeast of the port of Casablanca and includes the districts of El Boroudj and Oued Zem. The other two lie southwest of the first at distances of about 40 and 100 miles, respectively. Here the phosphate beds form parts of the same sedimentary series that is present in Algeria and Tunisia. The series, which includes many phosphate beds, is 200 to 275 ft. thick. Individual phosphate beds are as much as 8.4 ft. thick and are associated with beds of flint, clay, and limestone. In the northern area the phosphate beds, which are nearly horizontal, occupy a belt 50 miles long and from 3 to 20 miles wide. The phosphate content is said to average 73 to 78 per cent of tricalcium phosphate. Average tenor of the shipments has been about 76 per cent.



Typical view in Aspen Range in the Western phosphate field near Soda Springs, Idaho

Morocco Has Richest Deposits

The deposits of Kourigha are said to be the richest and most important yet discovered. The tenor is said often to exceed 80 per cent. Estimates of reserves for the northern area are 1,000,000,000 metric tons. This will doubtless be enlarged when more is known of the other areas. The exploitation and marketing of the Moroccan phosphates is in the hands of a government organization known as "L'Office Chérifien des Phosphates." Standard-gage railway connections have been established between the mines and Casablanca, and the grade of the tracks is such that cars loaded with phosphate may travel much of the way by gravity. Improved facilities for handling phosphate have been installed at Casablanca, so that vessels can be loaded at the rate of 350 metric tons per hour. Total shipments in 1924 were 125 per cent greater than in 1923, and in 1925 they were 67 per cent greater than in 1924. Sales in 1925 amounted to 720,688 metric tons.

Oceanic Islands—Although reserves of phosphate in the oceanic islands are small compared with those of Russia, they are of greater present importance from the standpoint of production. The most important of these are Nauru and Ocean islands, the Gilbert and Ellis islands, and Christmas Island (all British), Makatea Island (French), Rasa and Angaur islands (Japanese), and Curaçao and Aruba islands (Dutch). In 1924 these islands together contributed 14 per cent of the world's production.

Nauru and Ocean Islands—The largest producers among the oceanic islands are Nauru and Ocean islands, in longitude about 167 deg. E., just a few miles south of the equator. They are 165 miles apart and about 2,200 miles from Sidney. Nauru was formerly German, but Ocean Island has continued a British possession. The phosphate rock is generally a friable light-brown soil overlying coralline limestone, but locally it is hard. Grades range from 85 to 88 per cent of tricalcium phosphate. Reserves for the two islands are estimated at 140,000,000 tons—90,000,000 tons for Nauru and 50,000,000 tons for Ocean Island. Exports for 1924 were 459,162 metric tons, or 5.80 per cent of the world's production.

The islands are surrounded by coral reefs which descend to deep water, so that special types of loading devices have had to be installed. Under the terms of the Nauru Island Agreement, made in 1919, phosphate production has been in the hands of a commission representing the United Kingdom, Australia, and New Zealand, respectively, and allotments of the product are made on the basis of 42 per cent to each of the first two countries named and 16 per cent to the last.

Deposits in Islands in the Orient

Gilbert and Ellis Islands. — A small production is recorded from the Gilbert and Ellis islands, but no data are available regarding reserves and grades.

Christmas Island lies in the Indian Ocean, about 190 miles south of Java. The phosphate deposits are similar to those of Ocean Island. The rock contains on the average about 80 per cent of tricalcium phosphate. Large reserves are said to be available.

Makatea Island, one of the Society group, about 120 miles north of Tahiti, has an area of 1,200 acres and

is reported to possess reserves of phosphate amounting to 10,000,000 tons. The phosphate is easily worked and has an average grade of about 80 per cent.

Angaur and Rasa Islands, located at distances of 500 miles respectively east of Mindanao, in the Philippines, and of Formosa, are the chief sources of Japanese production, Angaur Island having been formerly a German possession. This island has reserves estimated at about 3,000,000 metric tons of rock, averaging about 80 per cent. The phosphate of Rasa Island is poorer in quality — about 75 per cent — and has an objectionably high percentage of iron and alumina. Reserves are reported to be about 3,000,000 tons.

Curaçao and Aruba Islands, off the coast of Venezuela, contain phosphate which ranges in grade between 80 and 85 per cent. The rock is very hard and difficult to handle. No estimates of reserves are available, but production in 1925 amounted to 81,771 metric tons.

Large Low-Grade Reserves in Russia

Russia—The Russian field, including deposits in southwestern Siberia, has produced little as yet, but represents a region of great future possibilities from the standpoint of fertilizer manufacture. The phosphates are of sedimentary character and of enormous extent. Better-grade rock, which has been mined chiefly in the regions of Podolia and Bessarabia, is said to have averaged about 75 per cent in tricalcium phosphate. The great bulk of the phosphate, however, which is distributed in a number of regions centered about Moscow, is of poorer grade. Poor transportation facilities have hindered development. Estimates have been made that European Russia has 5,568,000,000 tons of phosphate reserves, of which 141,000,000 tons has a phosphoric acid content of over 24 per cent (about 52 per cent tricalcium phosphate), 1,707,000,000 tons with 18 to 24 per cent (39 to 52 per cent tricalcium phosphate), and 3,720,000,000 tons with 12 to 18 per cent (26 to 39 per cent of tricalcium phosphate). In the government of Uralsk, in southwestern Siberia, there is reported to be 600,000,000 tons of phosphate rock, with 30 to 43 per cent of tricalcium phosphate, and in the adjoining government of Turgai a similar deposit is reported with 67,000,000 tons of phosphate rock containing 40 per cent of tricalcium phosphate. Thus Russia and Siberia together contain estimated reserves of 6,235,000,000 tons. There has been no production in Siberia, and in Russia in 1924 it was only 20,014 tons, an amount equal to about one-quarter of 1 per cent of the world's total.

Spain—Apatite veins in the Province of Caceres have been worked for many years on a relatively small scale. Some of the material has been of very high grade, 92 per cent of tricalcium phosphate, but the quantity is limited and Spain has imported a large part of her requirements. More recently the discovery of low-grade phosphate rock in the Province of Murcia has been announced. It is estimated that this deposit contains approximately 10,000,000 tons of phosphate. According to a published statement containing analyses, the rock is glauconitic, with 20 to 30 per cent of tricalcium phosphate and 7 per cent of potassium. Spanish production in 1924 was 6,746 metric tons.

France—Formerly the French domestic deposits were of considerable importance, but as the grades range from 40 to 65 per cent and some as low as 25 per cent of tricalcium phosphate, they are now unable to compete with the cheaper, high-grade phosphate of Florida and North Africa, and production has consequently declined. It is reported that 226,000 metric tons was produced in 1925.

Belgium—The principal phosphate-mining region of Belgium is near Mons. Before high-grade American and Pacific islands deposits were developed Belgian phosphates were of considerable importance, but latterly the output has greatly declined, as the average grade of rock obtainable is only 40 to 45 per cent tricalcium phosphate. In 1924 only 26,250 metric tons was produced.

Germany Gets Byproduct Phosphate

Germany—Before the war no deposits of phosphate rock of commercial importance were known in Germany, though in her island possessions she controlled large reserves of very high-grade rock. In 1918 a deposit was found near Nuremberg, Bavaria. This attains a thickness of 10 ft. in many places and is in the form of bi-basic phosphate of lime. In certain workings a product was found containing 80 per cent tricalcium phosphate, but as a whole it has been estimated to average 35 per cent tricalcium phosphate. German production in 1924, including small amounts mined in Prussia as well as in Bavaria, was 1,399 metric tons, or about 0.02 per cent of the world's production. Germany is able to meet a large part of her phosphate requirements by using basic slag, a byproduct of the smelting of phosphatic iron ores, the annual output of which is about 1,000,000 tons.

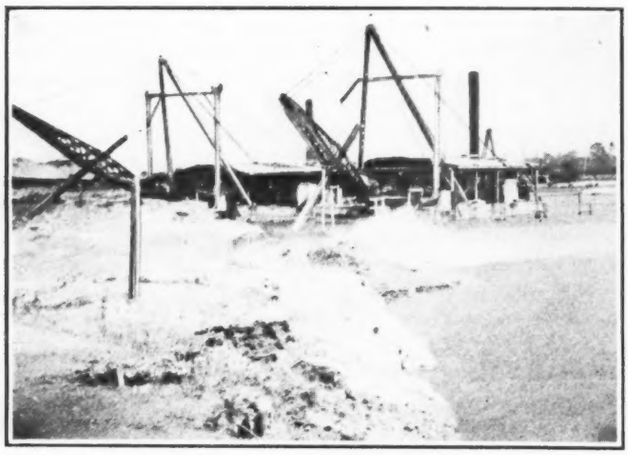
England—Formerly phosphate rock in the form of nodules was obtained at many places in England. Following the discovery and exploitation of the great American and North African deposits, phosphate mining in England ceased to be profitable and was abandoned.

Palestine—Low-grade phosphate rock in sedimentary deposits of considerable extent and high-grade vein deposits along a fault line are reported as occurring between Es Salt and Ammon, on the east side of the Jordan. Sedimentary deposits occur also on the west side of the Jordan. These various sedimentary deposits average about 48 per cent and the vein deposits 77 per cent of tricalcium phosphate. The latter have been explored by a French company, but no output has been reported. Estimates of reserves range between 3,500,000 and 14,000,000 metric tons.

Railroad in Palestine May Help

These deposits were long considered as inaccessible. During military operations in Palestine, however, a railroad was constructed from Medina to Haifa. The line runs parallel to the Jordan about 30 miles east of the Jordan Valley and passes very close to the eastern side of the deposit at Es Salt. The distance by rail from Ammon to Haifa is 151 miles and the route is circuitous.

China—Apatite containing 90 per cent tricalcium phosphate occurs at Tung Hai Hsien, on the Chao Ho River in Kiangsu Province, eastern China, about 10 miles from the sea. A narrow-gage railroad connects the mines with the river front. About 6,000 tons of ore has been mined, but operations are now suspended. The ore is friable and easily ground. It occurs with manganese ore as replacement in limestone associated with gneissic rocks.



Dredging phosphate at Buttgenbach Co.'s mine in hard-rock field near Dunnellon, Fla.

Japan—In the province of Noto, in the Bonnin Islands, and in Formosa Japan has low-grade phosphates. Rasa Island and Angaur Island, as previously noted, are also Japanese. In addition, several islands of the Marshall group, formerly German, are now under Japanese control. Japan in 1924 produced 85,617 metric tons of phosphate, not including that produced by Angaur Island.

Australia—The largest deposits of rock phosphate so far discovered are in South Australia. These are distributed intermittently along a belt of country some 200 miles long from Myponge on the south to Carrieton on the north. The phosphate is associated with older limestones, quartzites, and sandstones. Phosphates are also present in New South Wales (cave deposits), Queensland (guano), and in Victoria (like those of South Australia). All are of low grade except some apatite, which ranges up to 78 per cent tricalcium phosphate. Some deposits are of aluminum phosphate. Production in Australia in 1924 was only 745 metric tons.

New Zealand—The known phosphate deposits of New Zealand are of small size, and, with the exception of those in the Clarendon-Milton district of Otago, are of little commercial importance. Those of the Milton district occur as segregations in later limestones. Higher-grade rock ranges from 65 to 80 per cent tricalcium phosphate. The total iron oxide and alumina varies from 1.4 to 9 per cent. New Zealand produced 1,600 metric tons in 1924.

Canada—Apatite deposits in Canada were formerly extensively worked, but now are practically idle. The more important deposits are in Ottawa County, in Quebec Province, in a belt 15 to 25 miles wide. Other deposits are in Ontario, occupying a belt south of Ottawa River, nearly to the St. Lawrence, a distance of about 100 miles, with a width of 50 to 75 miles. Canada also has sedimentary phosphates similar to those of the Western states in the United States, but probably of lower grade. They are undeveloped. No production was reported from Canada in 1924, but 37 tons was reported in 1925.

West Indies—On Redonda Island, one of the Leeward group, deposits of aluminum phosphate occur as veins in the volcanic rock of which this island is composed. The veins vary in thickness from a few inches to 2 ft. No production has been reported in recent years. Curacao and Aruba, off the coast of Venezuela, already have been mentioned.

Phosphates are also mined on the Island of Salut and Grand Connétable Island, near the coast of French Guiana.

Peru—In the department of Ica there is a deposit of nodular phosphate. It is not used, because of the local preference for guano.

Chile—A large and rich deposit of phosphate is reported to occur in the valley of Huasco River about 300 miles north of Valparaiso. It has not been developed. A small production of apatite was reported prior to 1923, but no production has been reported since that date.

Table II, showing the world's production of phosphate for the period 1921 to 1925, was prepared by Miss L. M. Jones, of the Bureau of Mines.

Table II—World's Production of Phosphate Rock, 1921-1925

Metric Tons

Country	1921	1922	1923	1924	1925
Algeria	398,800	484,304	467,384	681,136	716,630
Angaur	[1]30,500	46,204	61,243	[2]	[2]
Australia					
New South Wales	203	12	75	109	203
Queensland	375	66	.....	.....	[2]
South Australia	5,161	2,759	453	85	[2]
Victoria	1,566	1,114	488	541	.....
Belgium	55,040	56,840	23,270	26,250	[2]
Canada[3]	27	172	27	.....	37
Chile[3]	1,?00	500	[2]	[2]	[2]
Christmas Island (Straits Settlements)[4]	87,893	100,947	71,563	127,166	[2]
Dutch West Indies:					
Curacao[4]	60,872	50,078	85,855	100,471	81,771
Egypt	122,024	60,220	25,370	85,869	[2]
France	111,984	146,526	179,462	[2]	[7]226,000
Germany[3]					
Bavaria	7,959	4,412	2,975	1,000	[2]
Prussia	925	657	2,311	399	[2]
Gilbert and Ellis Islands[5]	[2]	152,368	136,506	192,516	[2]
India (British)	353	1,362	4,838	6,529	[2]
Indo-China	9,900	7,600	9,847	12,461	[2]
Japan	32,001	12,320	33,107	85,617	[2]
Taiwan	18	[2]	[2]	[2]	[2]
Madagascar[4]	.....	5,210	.....	749	[2]
Makatea Island	60,000	71,350	74,230	89,611	[2]
Morocco, French	33,000	96,397	225,395	461,582	[4]720,688
New Caledonia	5,000	5,142	12,932	[2]	[2]
New Zealand	6,108	3,178	2,421	1,600	[2]
Norway[3]	1,068	.....	222	345	[2]
Ocean and Nauru Islands	[5]370,000	[5]367,000	[6]316,652	[6]459,162	[6]479,000
Portugal	1,054	[2]	[2]	[2]	[2]
Russia	[2]	14,136	21,044	20,014	[2]
Spain	38,064	6,492	5,397	6,746	[2]
Tunisia	1,800,000	2,117,650	2,357,000	2,391,000	2,691,000
United States	2,097,153	2,456,690	3,054,964	2,913,817	3,537,702

1, estimated annual production; 2, data not available; 3, apatite; 4, exports; 5, production in the fiscal year ended June 30 of year stated; 6, exports during the fiscal year ended June 30 of year stated; 7, D. J. Reagan, Trade Commission, Paris. Quoted *American Fertilizer*, July 10, 1926, p. 45.

The estimated world reserves of phosphate are shown in Table III. These are not to be considered as official. They represent what I was able to gather from many sources. They vary in methods of computation and in standards of accuracy. Some of them are very conservative; others are admittedly large, being hardly more than guesses.

Table III—Estimated World Reserves of Phosphate

Country	Reserves (Metric Tons)	Grade (Per Cent)
United States	6,431,000,000	Mostly over 60 and large quantities over 70.
Tunisia	1,000,000,000	58–68
Algeria	1,452,000,000	58–68
Morocco	1,400,000,000	70–78
Egypt	179,000,000	60+
Nauru and Ocean islands	140,000,000	80–88
Makatea Island	10,000,000	80+
Angaur Island	3,000,000	80+
Rasa Island	3,000,000	75
Palestine	14,000,000	47–80+
Total high grade	10,632,000,000	Generally 58+
Russia	5,568,000,000	Less than 58
Spain (Murcia)	10,000,000	Less than 58
Siberia	667,000,000	Less than 58
Total low grade	6,245,000,000	Less than 58
Grand total	16,877,000,000	

Solving a Problem in Silver-Lead Ore Concentration

Analysis of Screened Products and Microscopical Study Shows What Minerals Are Present and Suggests Method of Treatment

By Ernest W. Ellis

Metallurgist, Idaho Bureau of Mines and Geology

IN MOST OF THE LEAD ORES of the Coeur d'Alene district, the ratio of silver to lead is fixed. This ratio varies slightly from mine to mine, but is usually constant in a given vein as soon as the zone of oxidation is bottomed.

Typical ore from the Wardner section was used in this study. Such ore has a silver-to-lead ratio of approximately 0.33 oz. of silver per ton to the unit of lead. When the ore is crushed and concentrated, however, the ratios of silver to lead in tailing and in concentrate differ from those in the mill feed. The purpose of this investigation was to study the relationship of the silver to the lead during crushing and concentration and, further, to determine the form in which the silver occurs. The following concentration data were obtained in an earlier study already published.[1]

Table I shows how closely the silver-lead ratio holds to 0.33. In the one or two instances where the ratio is 0.32 or 0.34 it is quite as likely to be due to the assaying as to a change in the real ratio.

The various spigot products of classified feed were concentrated on a Wilfley type table with results as follows:

Table I—Distribution of Silver and Lead in Screened Products of Bunker Hill Ore

Mesh	Per Cent	Cumulative Per Cent	Pb, Per Cent	Ag, Oz. per Ton	Ag: Pb Ratio
+20	2.1	2.1	11.1	3.7	0.33
28	5.9	8.0	16.8	3.5	0.33
35	10.2	18.2	18.1	6.0	0.33
48	15.4	33.6	17.4	5.8	0.33
65	17.9	51.5	15.8	5.4	0.34
100	19.8	71.3	17.7	5.8	0.33
150	19.1	90.4	24.9	8.5	0.34
200	1.3	91.7	32.4	10.7	0.33
—200	8.3	100.0	44.5	14.4	0.32
	100.0				
Total feed			21.3	6.9	0.32+

Table II shows the silver-lead ratio in the concentrate products to be slightly under the average silver-lead ratio in the feed (Table I). On the other hand, the middling products show the silver-lead ratio in tne first three spigot products to be nearly the same as that of the average feed, but the remaining spigots show a constantly increasing silver-lead ratio. The silver-lead ratios of the tailing, although variable, are all higher than the average of the silver-lead ratio of the middling.

It is my belief that the data point to two occurrences of a silver-bearing mineral. In the one case the silver bears a fixed ratio to the lead in the pure galena and follows the galena consistently throughout all the various stages of concentration. This ratio, however, is slightly lower than the ratio of silver to lead in the average feed. On the other hand, some silver-bearing mineral in the ore, as it becomes liberated by increasingly finer crushing, works its way down the table into the middling and tailing. This would indicate a silver-bearing mineral of lower specific gravity than the silver-bearing galena.

Table II—Distribution of Silver and Lead in Concentration

	Concentrate			Middling			Tailing		
Spigot	Pb, Per Cent	Ag, Oz.	Ag: Pb Ratio	Pb, Per Cent	Ag, Oz.	Ag: Pb Ratio	Pb, Per Cent	Ag, Oz.	Ag: Pb Ratio
1	84.5	25.7	0.30	65.9	21.0	0.32	...	...	...
2	82.9	24.8	0.30	30.9	9.6	0.31	1.9	1.1	0.58
3	81.0	23.8	0.29	14.5	5.0	0.34	1.5	0.8	0.53
4	81.4	24.7	0.30	13.4	5.0	0.37	1.5	0.7	0.47
5	79.8	24.0	0.30	9.7	4.2	0.43	1.6	0.7	0.44
6	80.9	24.6	0.30	8.6	4.0	0.47	1.4	0.9	0.64
7	81.8	24.0	0.29	7.8	3.8	0.49	1.2	0.6	0.50
8	80.8	24.0	0.30	5.7	3.2	0.56	1.3	0.6	0.46
9	79.9	24.0	0.30	6.9	4.5	0.65	1.2	0.8	0.67
10	82.2	24.0	0.29	8.4	6.0	0.71	1.4	0.7	0.50
Weighted Averages(a)	81.8	24.5	0.30	16.0	6.9	0.43	1.4	0.7	0.50

(a)Silver ratios must be weighted when comparing total product ratios with average feed ratio.

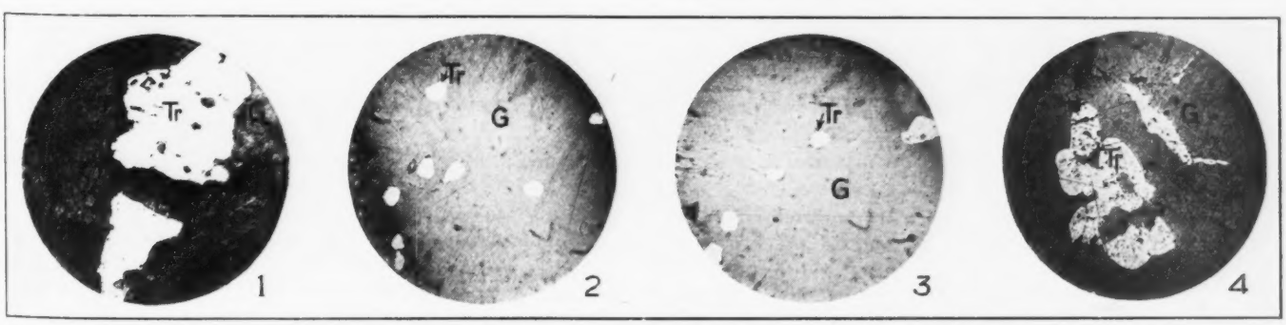
To study the occurrence of the silver, polished surfaces of galena were prepared, the specimens etched with hydrogen peroxide, and examined under the microscope. Small grains and plates of a galena-white mineral that remained untouched by the hydrogen peroxide were seen. The accompanying photomicrographs show this mineral with a magnification of 56 diameters. The dark background is the etched galena, marked *G;* the white part is the silver-bearing mineral, marked *Tr.*

The galena-white mineral proved to be negative to nitric acid, hydrochloric acid, potassium cyanide, and ferric chloride. It had a medium hardness and gave a positive result to all tests for tetrahedrite, and therefore is classified as such. Earl V. Shannon classified[2] the silver-bearing mineral in the Wardner ores as tetrahedrite.

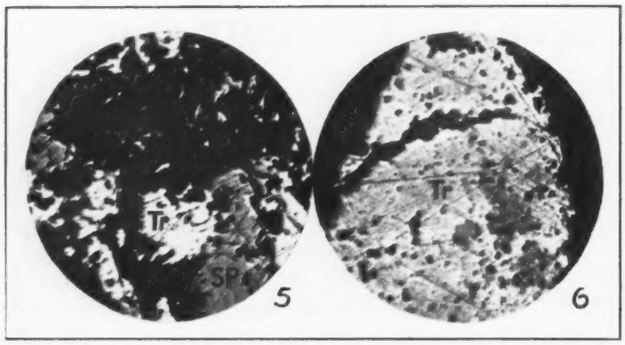
The grains of silver-bearing mineral in the galena are, however, of such microscopic size as to preclude their being responsible for the changes in the silver-lead ratio during concentration. It would appear, therefore,

[1]"Feed of Wilfley Type Tables." By Ernest W. Ellis, *Mining and Metallurgy*, April, 1926.

[2]The Minerals of Idaho. United States National Museum, Bull. 131.



Dark portions, marked G, are etched galena. Light parts, marked Tr, are tetrahedrite. Magnified 56 diameters



In photomicrograph No. 5, to the left, the dark portion, marked G, is etched galena. The light part, marked Tr, is tetrahedrite. The gray part, marked Sp., is sphalerite. No. 6, at the rigth, is a single grain of tetrahedrite. Magnification, 60 diameters

that there are other mineral grains that contain silver, but which are of lower specific gravity. A middling product was examined under the binocular microscope and the following minerals were detected: galena, sphalerite, siderite, quartz, pyrite, and an unknown. The unknown mineral had a galena-like lustre but lacked the crystal structure. Some of the mineral grains resembled extremely fine-grained steel galena, whereas others were less metallic. Microchemical testing of the polished grains brings out the fact that the unknown mineral is tetrahedrite. This combination would produce a mineral grain of relatively high silver content and of lower specific gravity than galena, and which would therefore appear in the middling and even in the tailing if the quartz and sphalerite content were high enough. See photomicrographs 5 and 6.

Photomicrograph 5 shows galena (the dark patches, marked *G*); sphalerite, *sp*; and tetrahedrite, *Tr*. Quartz and chalcopyrite did not show in this section. No. 6 shows a separate grain of tetrahedrite. The magnification in both 5 and 6 is 60 diameters.

It would appear therefore that the silver in the Coeur d'Alene ores, or at any rate those of the Wardner district, occurs as argentiferous tetrahedrite and that this mineral is distributed in microscopic grains throughout the ore. Tetrahedrite appears, however, in two entirely distinct occurrences; in one case, tetrahedrite is intimately associated with galena; in the other, tetrahedrite is associated with a mineral mixture which is a true middling product and which is proportionately lower in lead content than the clean galena. The conclusion naturally follows that any system of dressing this ore should include fine grinding, and possibly flotation, of both table middling and tailing, if a high silver recovery is to be expected.

Germany Develops Processes for Recovering Sulphur and Sulphur Products

THE shortage of sulphur, pyrites, and blende during the World War period forced German chemists to the development of substitute processes for the manufacture of sulphuric acid. Some of these processes are still in use and are valuable to the German chemical industry, because they utilize domestic raw materials. A brief description, given by William T. Dougherty, of Berlin, and published by the U. S. Department of Commerce, follows:

Processing of barytes is the source of all barium salts and of the important technical accumulator, sulphuric acid. In the manufacture of barium salts, barytes or heavy spar is reduced with carbon to barium sulphide; the latter is decomposed with acids, and while barium chloride or nitrate is produced, the hydrogen sulphide evolved is collected in gasometers and mixed in special chamber furnaces with a measured quantity of air to sulphur trioxide, and reduced to sulphuric anhydride. The amount of sulphur thus produced and processed is estimated at 10,000 to 12,000 tons annually.

Farbenfabriken vorm. Fried. Bayer, of Leverkusen, has developed a process that yields two valuable commercial end products—sulphuric acid and portland cement—from gypsum, clay, and coal in a revolving kiln. The calcium sulphate raw material processed at the Bayer plant is a residue from the manufacture of organic products. With the addition of coal, sand, and slags, the mixture proceeds for three hours through a revolving kiln, 50 meters long, and is led to the cement plant, the gases containing sulphur dioxide being collected in dust chambers and then in the sulphuric-acid plant where they are processed either by the lead chamber or by the contact method. This process is producing around 900 tons of sulphur dioxide and 1,000 tons of cement clinker monthly.

The sulphur content of gypsum is being successfully utilized by the Leunawerke air-fixation plant, in producing around 2,500 tons of ammonium sulphate daily. In this process, the calcium sulphate yields calcium carbonate and ammonium sulphate in the presence of ammonia, carbon dioxide, and water. Its greatest disadvantage lies in the inability of the producer to dispose of the calcium carbonate. The Badische presents each purchaser of three carloads of ammonium sulphate (30 metric tons) with one carload of calcium carbonate, f.o.b. Merseburg.

The Badische, at the Leunawerke, separates daily ten tons of sulphur (100 per cent pure) from waste gases, by washing them with alkali iron solutions, or slimes, to which tartaric or oxalic acid is added, and leading them through absorbent carbon or silicic acid. The Leunawerke treats 2,500,000 cubic meters daily for recovery of hydrogen sulphide. Sulphur was formerly harmful to subsequent reactions.

Blast-Furnace Slag Process (Diehl)

Diehl has developed a process calculated to recover the sulphur content of blast-furnace slag. This contains 1.5 to 2 per cent sulphur in the form of calcium sulphide. By introducing air into the liquid slag, this is deprived of its sulphur. In the presence of silicic acid, the calcium sulphide is broken up by the oxygen, forming sulphur dioxide, while the calcium unites with silicic acid to form calcium silicate. By adding gypsum the yield of sulphur dioxide is increased considerably. The slag can be processed, after the removal of sulphur, to cement.

Other processes are still in an experimental stage.

A part of the east rim of the crater showing drilling derrick at crest of the anticline. Note jumble of Kaibab limestone débris in left foreground

Is There a Canyon Diablo Meteorite?

Drilling Has Failed to Find Any in the Famous Arizona Crater

By F. LeRoi Thurmond

A LURID full-page feature article in a recent Sunday issue of a notorious saffron journal of San Francisco, on the Canyon Diablo meteorite, stated that the "meteor" had been found—in the breast of a "tunnel" 1,000 ft. long and at a depth of 500 ft. The article further stated that the "meteor" weighs twelve million tons, and that it is full of diamonds and priceless minerals, among which is three-quarters of an ounce of platinum per ton of "meteor." The platinum value of the mass is computed at over a billion dollars.

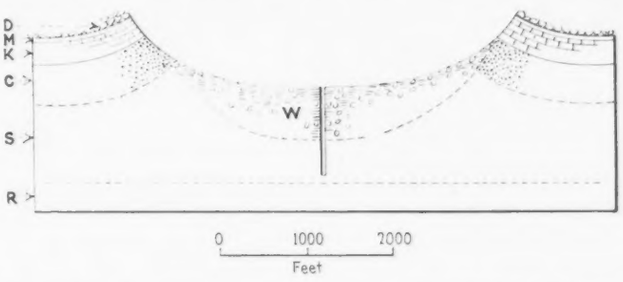
I visited the site of the supposed meteorite a year ago, and stimulated by the story of the discovery, mentioned above, recently paid a second visit. The meteorite has not been found, and things are in the *status quo* of a year ago; no work was being done, nor had any been done in the interim.

Much has been written on the phenomenon of the "Canyon Diablo Meteor." Able papers by Gilbert, Barringer, and Tilgman discuss the geological phases, while the metallography and mineralogy have been dealt with at great length by Merrill, Cohen, Kunz, Foote, Ward, and others. The phenomenon consists of a bowl-shaped crater in a limestone plateau, a few miles south of the Santa Fé railroad, southeast of Flagstaff, Ariz. It is roughly circular, has a diameter of 3,900 ft. and is 600 ft. deep. A rim encircles the crater and rises to 160 ft. above the level of the plateau. The horizontally bedded rocks are sharply upturned around the margin of the crater. The amount of this upturning varies from 150 to 200 ft., and the angles of dip of the upturned beds vary from 10 to 80 deg.

The geological section where exposed in the wall of the crater shows basal Moencopie (Permian) 25 ft.; Kaibab (Pennsylvanian) limestone, 200 to 300 ft.; with the bottom of the bowl in Coconino (Pennsylvanian) sandstone of undetermined thickness. A boring in the bottom of the bowl, 1,000 ft. deep, is reported to have found wash and pond deposits on rock fragments and rock flour.

The rim of the crater and the outward slopes are covered with débris from the crater, this débris being made up of sandstone and limestone, ranging from rock dust to huge blocks 30 ft. in thickness. This material is all jumbled as it might have fallen after a huge blast. The rim is of varying width, being about a half mile in general, but fragmental material is found two to three miles distant. One block of limestone 10 ft. through lies half a mile from the crater's edge.

G. K. Gilbert, of the U. S. Geological Survey, estimated the volume of the crater at 82 million yards and the amount of débris on the rim at approximately the same. Torrential rains have washed some of this detritus into the crater, forming a talus slope, and more of it down the outer slope. Aeolian erosion has had some effect upon the distribution of fine material, the northeast slope being covered with wind-blown sand, indicating prevalence of southeast winds. Masses of iron-nickel alloy have been found around the crater and mingled with the débris on the rim and in the crater. About 90 tons of this material has been found, from masses weighing hundreds of pounds to specks which may be picked out of the dirt with a magnet. I have found over two hundred pieces, the largest weighing 8 oz. and the smallest ½ gram. They were mostly found a mile from the crater on the west side, and had been



Generalized section across "meteor crater." "D," débris; "W," wash and pond deposits; "M," Moenkopie formation; "K," Kaibab limestone; "C," Coconino sandstone; "S," Supai formation; "R," Redwall limestone

buried in the soil but had become exposed by torrential rains.

Many analyses have been made of this iron, with considerable variation even from different parts of the same specimens, as the following typical results by Moissan, given in percentages, show:

	Fe	Ni	SiO_2	"Insol."	Mg	P	S	Total
1	91.12	3.07	0.050	1.47	Tr.	0.20	.....	95.91
2	95.06	5.07	.....	0.06	...	....	.....	100.19
3	91.09	6.08	0.050	....	...	....	0.045	92.00

The occurrence of diamonds in the iron was a matter of controversy for some time, but was later proved by Moissan, Friedel, and Huntington. Surrounding the crater and occurring with the iron are great quantities of laminated iron oxides having the appearance of hematite. They are magnetic angular fragments with sharp bounding planes, and all have the appearance of having been broken. Barringer and Tilgman report analyses of this material to show that it contains iron, nickel, platinum, and iridium in practically the same proportions as the metallic meteorites. No authority doubts the celestial origin of the iron-nickel masses, although they have been compared to the iron-nickel masses found in basalt at Ovifak, Greenland. The oxidized masses are evidently from the same source as the iron. It was the concurrence of the meteoric iron in great quantities, with the huge crater, which furnished a ready hypothesis for its explanation, to early observers. This theory was later questioned as not being sustained by the facts.

First, no meteorite has been found in the crater, although much exploration has sought to discover one. Secondly, there is no evidence on the rock débris of the metamorphic effects that would be caused by the impact of such a large super-heated metallic mass as the meteoric theory predicates. However, there is a plausible theory for the formation of the crater, in the known fact that it is in the midst of a region of recent volcanic activity, containing four hundred craters in a short radius. Zuni Salt Lake crater, a short distance to the southeast, is very similar, with the exception of ash cones in its bowl. It is perfectly conceivable that the crater was formed by an explosion of superheated steam due to the invasion of the Coconino sandstone by an intrusive mass which does not come to the surface. Gilbert has shown that superheated steam would have a pressure, at 800 ft., of 1,000 lb. per square inch, and a temperature of 280 deg. C. Sandstone under this pressure must have its interstitial spaces filled with superheated steam, and upon the sudden release of pressure through an explosion the internal tension would rend the rock into very fine particles, such as are found in the great quantities of bleached rock flour in the floor of the crater and on its flanks. The masses of overlying rock, not being subject to the high pressure, would simply be blown into fragments of varying sizes, depending on the structure and the varying forces of disruption, and this again coincides with the fact. The concurrence of the meteoric iron with the crater would then be merely a coincidence, and there appears no interrelation between the two phenomena.

That the iron became scattered as the result of the explosion of a meteor some time subsequent to the formation of the crater appears from the finding of fragments on the flanks and in the crater. That the meteor must have been tremendous is proved by the fact that more meteorites have been picked up here than in all the rest of the world combined. Estimates place the quantity at 90 tons.

It has been assumed by some observers that the meteor was volatilized and blown out of the crater by the heat of impact. This again does not coincide with observed phenomena. Numerous meteors have been observed by a great many persons, and in practically all instances they were seen to disintegrate and fall to the earth in showers, hundreds of specimens having been picked up after a fall, but in this instance the numbers run into many thousands.

When search by drilling in the bottom of the crater failed to find the meteorite, attention was directed to the possibility of its having slipped in between the strata of Coconino sandstone on the eastern side of the crater. A prominent mining company erected a drill on the rim and put a hole down to 1,600 ft., and then abandoned the project. There is a slight bulge or anticline here and a fault on the right limb with the downthrow on the side whence any disturbing influence must have come; if the anticline were caused by the injection of a foreign body, the reverse would have been the case. The anticline and fault appear to be normal phenomena incident to the geological habit of the region and require no extraordinary explanation.

Finally, I believe the evidence is competent to explain the crater on the hypothesis of a volcanic steam explosion, and that the proponents of the meteoric theory have failed to discover adequate support for their contention. It is rumored that another attempt will soon be made to discover the meteorite, which attempt will no doubt add something to our store of knowledge regarding the phenomenon.

Rock débris on northeast rim. The large blocks are Kaibab limestone

Discussion

Certain Geological Features of Bolivian Tin-bearing Veins

THE EDITOR:

Sir—Recently a number of articles have appeared in the "Discussion" columns of *E. & M. J.* commenting upon my paper on certain geological features of Bolivian tin veins in the issue of April 17. In this paper I brought out evidence tending to show that solution and redeposition of cassiterite is a common natural process, and that, as a consequence, secondary enrichment is an important factor to be considered in the geologic appraisal of Bolivian tin properties. The hope was expressed that observers from lode-tin districts in other parts of the world would contribute from their experience and show to what extent the process might have general projections, or, on the other hand, what might be considered as inhibitive conditions. I have already commented upon some of these contributions in the issue of Sept. 25.

In the Aug. 7 number of *E. & M. J.*, J. B. Scrivenor, geologist, Federated Malay States, states that there is no evidence of secondary enrichment by solution and redeposition of cassiterite in lode tin deposits of British Malaya, but does not go into greater details. It would have been very interesting if Mr. Scrivenor had mentioned some of his criteria in this connection, as well as a few descriptive details regarding topography and mineral associates. To me it seems probable that the topographic conditions of British Malaya, and, more especially, the mineral associates and purity of the cassiterite itself, might account for some of the differences in behavior observed between these lodes and those of Bolivia. I will again touch upon this point farther on.

Writing from Australia, James B. Lewis in the issue of Aug. 21 states that in his experience with tin lodes in Australia and Tasmania he has in very many cases seen payable ore in outcrops and shallow ground followed by low-grade ore; nor does he find an adequate explanation for this in the residual theory; that is, oxidation and removal of pyrite, which in the great number of outcrops observed was insufficient to account for the enrichment. On the other hand, he also mentions barren gossan outcrops followed by good tin ore. These facts tally closely with those observed in Bolivia, and constitute valuable corroboratory evidence as to the universality of the process of secondary enrichment of cassiterite. It is no more logical in Australia than in Bolivia to attribute the pronounced preference of the payable orebodies for the surface regions to primary mineralization factors. Why should the rich orebodies of a vein filled in Tertiary, Mesozoic, or Paleozoic time be localized near a twentieth century surface?

Since my article appeared in the April 17 issue I have received numerous communications from operators and engineers from other parts of the Bolivian tin field, which I had not personally studied, in confirmation of my views. The process of secondary enrichment seems to be even more general than I had imagined, but since the publication of the criteria established for a number of typical cases its recognition has been facilitated.

In this connection, in a recent examination of a well-known tin district lying wholly in the sedimentaries, I have come across another criterion which may be of interest. The pertinent facts are as follows: Two of the principal veins in the district, parallel, belonging to the same system, are neighbors, the distance between them being about 300 meters; both dip 60 deg. east. No outcrop was visible in either case. One of the veins in its course down the hillside left no noticeable topographic record. Its oxidized zone was shallow. The vein filling of its sulphide zone was compact, massive quartz, pyrite and siderite, with cassiterite as the ore mineral. The tin oxide was evenly distributed from wall to wall, rather coarsely crystalline, interlocked with the above-mentioned associates, often projecting into vugs, and in general giving the impression of primary mineralization; the vein apparently had not undergone much crushing or alteration since it was formed. Its companion vein was marked by a recognizable topographic depression. The original vein structure was entirely destroyed, due to solution or crushing, or to both. Pyrite was absent except for a few residual nests. The gangue was clayey decomposed country rock and friable disintegrated quartz. The tin ore occurs as finely crystalline, nearly amorphous cassiterite associated with disintegrated quartz, lying in lenticles on the *footwall* side of the 60-deg. dipping vein, and with the longer axes of the lenticles parallel to this wall. Note the difference between the uniform distribution of the cassiterite in the first mentioned or primary lode with its original vein structure still unimpaired, and the concentration of this mineral on the footwall, or, let us say, drainage, side of the broken-down secondary vein. To forestall possible suggestions of mechanical migration, it may be said at once that the physical condition of the vein absolutely excludes this possibility.

Why did one vein undergo these changes while its nearby blood-relation was left practically unaffected? Longitudinal faulting and fracturing, making the vein more permeable to solutions, perhaps; softer and more porous country rock of the continually varying beds of the sedimentary series, producing similar effects, perhaps; original physical differences in the vein, perhaps. Any one of these factors may have been primarily responsible for the divergent histories of these two veins, but the more immediate cause is that one was subjected to a much greater extent to the dissolving, breaking-down action of circulating surface waters than the other. The topographic record alone proves that.

So much for the geological evidence, which, as may be seen, is piling up, with several doubtful "precincts" still to be heard from. On the chemical side of the question, Gerald U. Greene, Llallagua, Bolivia, contributed a very valuable article to the discussion in the Sept. 11 issue of *E. & M. J.* At the very outset Mr. Greene scores a telling point when he shows that the purest obtainable crystals of Llallagua cassiterite con-

tain only 94 to 95 per cent of tin oxide, the other constituent being iron oxide. He infers an internal weakness of the Llallagua cassiterite (by extension, Bolivian cassiterite) due to difference of potential set-up when two minerals are in contact in acid solution, and thinks it might be a controlling factor in the solution of cassiterite. Mr. Spurr had already advanced this suggestion in the issue of April 17.

Mr. Greene then describes a number of occurrences in Llallagua of undoubtedly secondary cassiterite, and also cites analyses of mine water with quite an appreciable amount of tin in solution; but with austere conservatism, truly scientific, he does not claim that the source of the tin is primary cassiterite, even though admitting that the great mass of the field evidence points that way. He mentions one case of secondary cassiterite having been found associated with the sulphide minerals of tin, teallite, and frankeite, intimating that these minerals may have been the source. However, it is more than likely that these sulphides at Llallagua, at least those that I have seen from the Forastera vein, are themselves secondary: for instance, frankeite interlaminated with marcasite.

Mr. Greene then submits a table condensing the results of a series of experiments on the solubility of cassiterite with various reagents, some of which, like dilute sulphuric acid and possibly also phosphoric acid, might be expected to occur in the upper regions of the tin veins. His experiments extended over a period of eight months. In this time he was able to prove an appreciable solubility of cassiterite crystals. Divide Mr. Greene's eight months into time elapsed since the Pliocene, and the biggest Bolivian orebodies could have been dissolved and reprecipitated several times over, on the basis of his rate of solution. Furthermore, it is not unlikely that, if it were possible to reproduce natural conditions more closely, even a greater tendency to solubility would be shown: for instance, instead of dilute sulphuric acid as a solvent, an induced moist oxidation of a mixture of cassiterite and pyrite, or of cassiterite, pyrite, and chalcopyrite, where the sulphuric acid would be formed in the process of oxidation. My idea is that in such an experiment not only would the electro-chemical activity be intensified, but it may be that the oxidizing pyrite would obtain part of its oxygen by robbing from cassiterite.

There is a great discrepancy between the results obtained by Mr. Greene and those of Messrs. Gruner and Lin (*E. & M. J.*, June 5) under more or less similar conditions. The experiments of Mr. Greene were, if anything, conducted under more rigorous conditions, since he used crystals instead of powdered material. The explanation must probably be sought in the character of the tin mineral, as he pointed out. Gruner and Lin used cassiterite from Saxony, whereas Greene experimented with crystals of this mineral from Llallagua. If this is the reason it at once opens up a very interesting field for investigation. Mr. Scrivenor reports that there is no evidence of secondary enrichment in British Malaya. The purity of the Straits tin as compared with Bolivian tin is well known. Bolivian placers are relatively unimportant, or at least not commensurate with the importance of the lode deposits from which they were derived. Is it possible, then, that the great extent of the Straits placers is due to the relative purity, *et seq.*, insolubility of the cassiterite; while on the other hand, the more impure, and, as a consequence, more readily soluble Bolivian cassiterite does not survive a long distance from the parent lode? May we infer in the case of the impure cassiterite lodes an elemental condition propitious to secondary enrichment at lower levels, but not favorable to its long survival in the form of detrital tin in placers; and, on the other hand, in the case of the pure cassiterite lodes, less likelihood of secondary enrichment of the lode but a longer tail of detrital tin? Interesting questions, these, with a decided pounds and pence or dollars and cents bearing which cannot fail to impress the mining engineer.

With regard to the substantiation of the idea itself, of secondary enrichment by solution and redeposition of cassiterite, there has already been enough corroboratory evidence, both geological and chemical, brought out since my article appeared a few months ago, to firmly establish the principle. It has come to stay, and is no longer a parvenu to be looked upon askance. That no hard and fast rules can be laid down, and that it is dependent upon the number of geological factors in each particular case, may be seen in the example of the two sister veins cited in this article. It is perhaps not too much to say that its economic significance with respect to tin lodes is almost as great as that of secondary sulphide enrichment in the case of copper deposits.

My thanks are due to those colleagues who in answer to the hope expressed in my paper have contributed from their field experience or with experimental data from the laboratory, and to *E. & M. J.* for acting as a clearing house for the evidence submitted. F. R. KOEBERLIN.

Santiago, Chile.

Underground Orientation by the F. J. Weiss Method

THE EDITOR:

Sir—The *Engineering and Mining Journal*, Vol. 73, 1902, p. 578, and Vol. 74, 1902, p. 479, and the *School of Mines Quarterly*, Vol. 11, 1890, p. 333, afford evidence that some interest has been taken by American mining engineers in the method, originally proposed in 1857 by F. J. Weiss, of triangulating by a quadrilateral to two plumb wires suspended in one shaft in order to orient an underground survey. This is a method which has the advantage of allowing the plumb plane to be placed parallel, or nearly parallel, to the longer sides of a rectangular shaft—a disposition of the plumb wires which is commonly very desirable in shafts of this section at great depths where the wires are likely to be deflected from verticality by bending and swirling air-currents and eddies, falling water, and the like.

The bases of the quadrilaterals in the historic orientations at the Tamarack mine in 1901 were 19 ft. and 19.6 ft. long respectively, and good work was done, but trouble arises in applying this method when the shaft chamber is small and the base is consequently short, owing to the difficulty of centering the theodolite at the ends of the short base with the increased accuracy that is necessary.

The application of Gauss collimation to the F. J. Weiss method to evade the difficulty was due, I believe, to the late Professor Brathuhn, of the Clausthal Bergakademie, who suggested it in two or three lines of his "Lehrbuch der Markscheidekunst," third edition, 1902, p. 333; and in the fourth edition, 1908, p. 329, he added an illustration.

In an experimental trial in 1905 I successfully applied

Brathuhn's suggestion at Aberllyn mine, in North Wales. Unfortunately, on the strength of this one success, I published Brathuhn's suggestion in my section on mine-surveying in *Practical Coal Mining*, by W. Boulton and others, Vol. 6, 1907, p. 268. Owing to my treatise exceeding the limits imposed by the publishers, many amputations, omissions and compressions had to be made, and many footnotes and references to original sources were cut out. Among the excised references was that to Brathuhn's textbook above referred to. Consequently Professor Louis, in revising the classic work on "Mine-Surveying," by Bennett H. Brough for the new seventeenth edition, was misled into thinking that this application of Gauss collimation originated with myself, and accordingly gave me credit which is not my due.[1]

I have since had reason to regret my rashness in publishing this suggestion on the strength of one success. Additional experiments attended by poor results and a further study of the theory of Gauss collimation have shown me that Brathuhn's suggestion is fallacious. I hope to publish soon my reasoned recantation with observations on the best procedure for the F. J. Weiss method.

As given in Boulton's "Practical Coal Mining" (pp. 268, 225, 226, 227), my own original suggestions on the improvement in this method were two, as indicated in the following paragraphs:

1. Multiple measurements Circle Right (C.R.) and Circle Left (C.L.) of the angles in the shaft chamber, each goniometric measurement being preceded by centering anew; the C.R. measurements being preceded by centerings with the telescope pointing in one direction, and the C.L. measurements by centerings with the telescope pointing in the opposite direction. Such compensation-centerings can be readily effected by the various improved centering-stages with coarse and fine adjustments above the footscrews.

2. Use of the two-tripod method.

The gist of my present communication is that the Gauss collimation variant is to be shunned and that one of the foregoing should be applied in its place.

My experience with various centering methods using all sorts of plumbbobs, and mostly theodolites with centering-stages above the footscrews, has shown me that the centering by plumbbobs of proved precision is susceptible of very high accuracy; and for many years past, as my students know, I have condemned the combination of Gauss collimation with the Weiss method and recommended the compensation-centering method (No. 1 above).

I have long intended to write a paper of recantation, owning to my fault in recommending this application of Gauss collimation, and I am now seriously undertaking the task.

Only in August of last year, a new textbook appeared which devoted two pages to an elaboration of my brief account of the F. J. Weiss method as given in Boulton's work, but without indicating that course. I resolved at that time to endeavor to stop the further propagation of Brathuhn's error, but last year was more than filled with reorganizing my class work, carrying on a lengthy discussion on my paper on "Underground Orientation," etc. (*Trans.* I. M. & M., Vol. 34), and the correction of Brathuhn's error had to be postponed again and again until at last it became overlooked. I may perhaps be pardoned for having forgotten this duty to the public during a strenuous time, but the new reference in Professor Louis' edition of Brough's "Mine-Surveying" now compels me to act.

L. H. COOKE.

London, England.

[1]Brough, Dean and Louis, "Treatise on Mine-Surveying" seventeenth edition, 1926, p. 316.

Why Bother the Engineer?

THE EDITOR:

Sir—With that diffidence which is seemly on the part of one who has never held, nor desires to hold, public office, may I rise to remark that your editorial, "Dictatorship of the Engineer," in the Oct. 16 issue, is indeed conducive to pleasurable meditation, but points a needless, if not misleading, conclusion? It is more than faintly reminiscent of many *vox pops* on "Why Engineers Should Run for President"—the general burden of the epic being: the engineer is the ne plus ultra in the way of public servant because (1) he respects truth, (2) he thinks straight, (3) he faces facts, and so on ad lib.

May I not "point with pride" to the fact that such virtues *un*suit our Knight of the Slide Rule for service in public office as completely as a total lack of such attributes would make of him a faultless Senator!

In witness whereof: The late W. Wilson "kept us out of war"—until he was sure of his second term. A select gathering of bearded boobs, legal luminaries, and other hysterical morons recently signed a solemn protocol, for and in behalf of most of the so-called civilized nations of the world, to the effect that chemical warfare would not be allowed in future civilized (sic!) wars. A lawyer's wife, speaking of and for her senatorial-candidate husband, says: "Oh, of *course* George is wet *privately;* but *politically* he *must* be dry!"

Must we *all* join in the refrain? Or isn't it possible to leave-be a few who still believe in the multiplication tables, *both* privately and publicly?

Let the merchants, bankers, lawyers, and hacks keep up their fond pretence! Let them chant on in measured, sonorous cadence, but let Pasteur remain in his laboratory; don't make a dog-catcher of Helmholtz, or a congressman of Steinmetz! When the world wants health, science can heal; when the world craves destruction, science can provide it; when the world needs material comforts and conveniences, or a better, clearer vision of eternity, science can point the way—and for all that science can show or provide, the engineer can adapt and build. But, when the world howls for hypocrisy, hokem, bombast, something-for-nothing, polysyllabic nonsense, then let us make way for those who, by nature and training, are fitted to serve!

Let us realize that science is, in very truth, the dictator of our mortal coil, and that the engineer is prime minister and the whole cabinet rolled into one. Is it not logical to conclude, then, that he must find his reward in his *own* field, not elsewhere?

"Competition" is not only useless but abortive. Some way can be found of extracting a reward, or a share, in the "plutocratic conquest of this sunkist land, where the most astute Prophets of Mammon spend a month and a half of the year vacationing, a week and a half of the month conventioning, a day and a half of the week golfing, and an hour and a half of the day calling one another by first names and singing home-brewed nursery rhymes to the tune of 'John Brown's Body.'"

Denver, Colo. T. P. CAMPBELL.

Consultation

Corduroy for Recovering Free Gold

"Frequent mention has been made in your paper recently of the successful use of corduroy blankets in the treatment of gold ores, but I have not seen a detailed account of the process or of the blanket used. In the course of some experiments with canvas-covered tables on a stamp mill tailing I have come to the conclusion that better results might be obtained with a different material, and I would greatly appreciate any data you might be able to give on the material used and the construction and pitch of table. Also, if a special material is used, where it might be purchased."

You will find an excellent article, by F. Wartenweiler, covering the use of corduroy blankets for recovering gold, in the *Transactions* of the Chemical, Metallurgical and Mining Society of South Africa, February, 1923.

In South Africa most operators use their old amalgamation tables, merely covering the old plates with the corduroy cloth. For new installations they would make tables similar to those formerly used as substructure for the plates, and cover the surface with the corduroy cloth.

We understand that the material they use is the ordinary cheap grade of corduroy. Strips are placed transverse to the flow of the pulp, so that the ridges of the cloth act as riffles. The strips, about 30 in. wide, are laid across the table. The weight of the wet cloth holds the blankets in place.

Cloths are removed at intervals of four hours. In changing cloths the pulp is diverted to a second table, a little fresh water is allowed to wash off the accumulated sand, and the cloths are folded up and taken to clean-up room. New cloths are laid down and the flow is restored.

In the clean-up room the cloths are washed and the resulting concentrate is collected at intervals and cleaned by sending it over a small Wilfley table. The Wilfley table produces first a streak of clean gold, a middling consisting of gold, pyrite, and considerable iron accumulated from the various machines, and a tailing which is sent back to the head of the plant. If the gold streak from the table is clean enough it is saved for direct melting, while the middling is put in a clean-up barrel and ground with small steel balls for about eight hours. Mercury is then added and further grinding carried on. The product in the barrel is finally washed and the amalgam recovered.

In South Africa the tailings from the clean-up barrel are accumulated and receive a final treatment in a laboratory-size cyanide plant. Plate amalgamation has been practically eliminated, although we understand the substitution of corduroy has decreased the primary recovery of gold slightly. However, the final recovery after cyaniding the tailings has not been affected.

Some of the chief advantages of the blankets are minimizing the chance of theft and a saving of about 70 per cent in the amount of mercury used.

In the gold districts in northern Ontario some operators find cheap blankets more economical and almost if not quite as effectual as corduroy.

Lead-Zinc Ore Schedules

"I have heard that several companies in the West are willing to pay for both lead and zinc in some classes of complex ores. Can you tell me on what basis payment is made for such ores?"

The principal market is for ores of milling grade rather than smelting ores. The purchasing company makes a selective separation by concentration. Ore of smelting grade usually must pay a penalty for the zinc above 6 or 8 per cent, for the reason that there is no opportunity for the purchaser to remove the zinc before sending the ore to the lead smelter.

A definite contract cannot be arranged until after tests have been run on large samples of the ore to determine the recoveries that can be expected.

The following general schedule is prepared by the United States Smelting, Refining & Mining Co. The figures in italic are representative figures that vary with the particular contract and are to be regarded as indicative only.

SETTLEMENTS: Settlements for products shipped hereunder shall be made in accordance with the following schedule of payments and charges, per ton of 2,000 lb., dry weight. No payment shall be made for any constituent of the Seller's product not provided for hereinafter. A unit is 1/100 of a ton, or 20 lb.

METAL PAYMENTS

Gold: Pay for *60-70%* of the gold contents at $19.00 per ounce. No payment if less than .02 ounce per ton.

Silver: Pay for *60-70%* of the silver contents (minimum deduction one ounce per ton) at the New York quotation as published in the *Engineering and Mining Journal* for date of smelter assay, less.....c. per ounce. No payment if less than one ounce per ton.

Copper: Pay for .....% of the copper contents on the basis of the wet assay (minimum deduction.....unit) at the average New York quotation for electrolytic cathode copper as published in the *Engineering and Mining Journal*, for the *E. & M. J.* week previous to date of receipt, less 6c. per lb.

Lead: Pay for *60-70%* of the lead contents (as per wet assay, less *1½* unit) at the average New York quotation as published in the *Engineering and Mining Journal*, for the *E. & M. J.* week previous to date of receipt, less *2c.* per lb. No payment if less than *3* per cent settlement assay.

Lead and Copper: Pay for.....% of the lead and copper combined (as per wet assay less.....unit), at the average New York quotation for lead as published in the *Engineering and Mining Journal*, for the *E. & M. J.*, week previous to date of receipt, less.....c. per lb. No payment if less than.....per cent settlement assay.

Zinc: Pay for *60-70%* of the zinc contents at *90%* of the East St. Louis price for zinc as published in the *Engineering and Mining Journal*, for the *E. & M. J.* week previous to date of receipt. No payment for zinc if product contains less than *3* per cent zinc.

Special Payment: For each% ..... in excess of.....% add 1% to the percentage.....paid for; but in no event shall the percentage.....paid for exceed.....%.

For each %.....in excess of.....% add to the payment for such metal.....c per lb.; but in no event shall the additional payment per pound exceed.....c per lb.

Treatment Charge: *$1.00-1.25* per ton.

Principal Lead Producers

"Have noticed with interest the data in the *E. & M. J.* ranking the copper producers in North America. Can you supply a similar table of lead producers?"

Some of the important lead-producing companies with approximate figures for mine output for 1925 are as follows:

Company	Production, Tons	Company	Production, Tons
St. Joseph Lead	154,654	Park Utah Con.	18,466
Consolidated M. & S.	118,040	Ahumada	16,792
Federal M. & S.	44,018	Chief Consolidated	11,102
Bunker Hill & Sullivan	37,974	Erupcion	10,286
Hecla	27,388	Potosi	10,226
Tintic Standard	24,036	Utah Delaware	8,780
Utah-Apex	22,852	Mazapil	7,870
Silver King Coalition	20,948	Bingham Mines	7,172

News of the Week

Summary

RECLAMATION work at Barnes-Hecker mine well under way; state mine inspection may be recommended in addition to present county system.

Guanajuato mines suspend on account of low price of silver—Greene-Cananea announces important ore discovery.

Federal Mining largest producer in Joplin-Miami district—Golden Rod mill destroyed by fire.

U. S. Vanadium Co. sold to Union Carbide—Present tungsten tariff likely to remain unchanged.

South American Gold and Platinum Co. adds motor ship to equipment.

Kennedy mine completes electrical installation.

Kirkland Lake may have additional power soon—Central Manitoba Mines plans future development—Tonopah-Canadian acquires additional property—More copper discoveries in Rouyn area.

Government operation of mines in Queensland a failure—Much interest in Tasmanian tin—London tin price down.

Alaska Juneau deficit $8,200 for month of September—Haiti Mines developing copper property.

Pilot plant of Lydenburg Platinum gives satisfactory returns; capacity to be increased.

Hudson's Bay Co. claims mineral rights on post lands; case now before Supreme Court of Canada.

Calles Asks Modification of Mining Laws

Mexican Mining Stocks Decline 30 per Cent—Readjustment of Wages

By W. L. Vail

Special Correspondent

President Calles of Mexico has sent to Congress a modification of certain articles of the mining laws, which are intended to better the condition of silver mining throughout the republic. The provisions are transitory, and will be in force, if approved by Congress, for the period of six months. It is the government's belief that conditions will become more or less stabilized by that time, through a system of general adaption to conditions, and possibly a partial recovery in price of silver. The provisions provide for a graduated tax which will cover the fluctuations of the market. A readjustment of freight rates on ores which cannot stand the present rates is also promised. The principal worry of large mine operators at this writing, as well as industrial and agricultural companies in general, is the proposed new labor law, now under discussion in both the upper and lower houses of Congress. As backed by the government, it is decidedly socialistic in conception, and it is described by the business interests affected as ruinous.

The work of readjustment in the question of wages is being undertaken at most of the large mines which contemplate a continuance of operations. As a rule the labor unions are assisting in a conciliatory manner.

No silver coin has been minted for the last two months. Owing to the retirement from circulation of silver coins of the old issues, there is a considerable amount of silver on hand at the mint in this city, which is being minted and alloyed to the standard of 0.720 fineness (official) and will be minted into coins whenever the demand warrants. Two million three hundred thousand pesos in gold coins of 50, 20, 10, and 5 peso denominations and seventy thousand pesos in bronze 5c. and 10c. coins were coined during September.

According to a statement published in the *Boletin Financero*, stock values of thirteen of the principal mining companies now operating dropped 5,700,000 pesos in value from July 28 to Oct. 8, due to the fall in the price of silver, fear of the results of the new labor legislation, and the effects of recent mining laws and decrees. The statements published follow:

Value of Shares in Pesos

	July 28	Oct. 19
Alacran	324,000	164,000
Angustias	378,000	98,000
Aurora	375,000	250,000
Rorda Antigua	216,000	108,000
Chontalpan	385,000	308,000
Natividad	1,612,800	1,411,200
Peñoles	1,500,000	1,500,000
Refugio y Virginia	1,855,000	1,750,000
Rodriguez Ramos	500,000	450,000
San Rafael y Anexas	6,160,000	3,410,000
Santa Maria de la Paz	2,849,000	1,850,000
Santa Margarita	4,020,000	3,300,000
Socavón de S. Fernando	160,000	160,000
Total (pesos)	20,334,800	14,759 200

Reports from the Peñoles headquarters state that the Calabazas mine, near the Amparo, Jalisco, is under option; that work may be expected to start soon on the Tetipac mines, Guerrero; that the properties worked by the Cedral Unit have been returned to the owner, M. Villareal, who is working the same; and that the engineers of the exploration department are still working at San Pedro de Corralitas, Chihuahua.

Through a confusion in names, it was improperly reported that the Peñoles people had suspended work on the Aurora mines, in the State of Guanajato, under exploration option. The report is officially denied by the owners of the company. It is understood that work has been suspended by the Peñoles on the Aurora mine, at Cuchillo Parada, State of Chihuahua, and the name has probably been confused with the Aurora de Xichu, State of Guanajato.

Total production of the Boleo camp, Lower California, for the first nine months of this year was 7,430 tons of copper, against 5,089 tons for the same period of 1925. The ore averages over 4 per cent.

Time Extended for Revision of Mining Titles

The time limit for presenting mining titles for revision has been extended to Feb. 12, 1927.

The Chihuahua Mining Chamber has issued a circular to its members setting forth data to prove that the new mining laws are seriously injuring the mining industry in that state and practically defeating the altruistic purposes which the government evidently had in mind when the laws were promulgated. Among other facts is cited the falling off in mining denouncements. For the entire year of 1925 and the first six months of this year the average number of daily denouncements reached thirteen. Since the law went into effect the average has dropped to three daily. The chamber, in common with other mining chambers of the republic, has addressed a memorial to the government authorities in this city, asking for a revision of the laws.

Northern California Mining Activities

At Grass Valley, Calif., the Western Meyer Mines Co., of Nevada, has obtained control of the Davis Brothers' mining claims northeast of Nevada City. Operations will be under H. B. Skewes. The Associated Mines, Inc., has acquired control of the Pay Divide and Blue Gravel mines, in the Howland Flat district of Sierra County. A permit has been issued for the transfer of stock by the California State Corporation Department. In Plumas County, J. F. Buel is employing eight men at the Bunker Hill mine. Gardners Point, Howland Flat, and South Fork mines are employing small working crews. The City of Six mine, at Downieville, Sierra County, has been shut down. Supplies are being stored at the Gibraltar mine for winter operation, and hydraulicking is to be started at Goodyear's Bay, on the Costa claims, as soon as water is available.

The Mountain Copper Co. has shut down the Iron Mountain mine near Matheson for the winter, laying off about twenty men. At the Hornet work continues with 240 men. Hoisting machinery used on the gravity tram of the Mammoth mine is being dismantled and shipped to the Yosemite Portland Cement Co. at Merced.

A 2½-cu.ft. bucket Straub dredge, formerly operated near Baker, Ore., has been dismantled and is being re-erected at Cottonwood, Calif., by Ogden and Wilson, gold-dredge operators.

California Copper Passes Dividend

The California Copper Co., controlling Engels copper mine, has passed its regular quarterly dividend. No further dividends are to be paid for the present, and the company plans to extend its exploration operations. An operating profit of $211,855 was earned during the first nine months of 1926. Dividends to the amount of $215,817 were paid in the year.

North Star Mines Increases Tonnage

North Star Mines, at Grass Valley, Calif., has increased its milling tonnage to the full capacity of its stamp mill. Good ore has been discovered on the 6,600 level of No. 2 winze. Primary deep development of the North Star is nearing completion. The vertical shaft lacks only a few feet of connecting with No. 1 winze.

Demarest Mine Reopened

The Demarest mine, Fourth Crossing, Calaveras County, Calif., is being reopened by J. C. Benson and C. Jorgensen, of San Francisco. A new headframe and new buildings have been completed. Old buildings, with the exception of the mill, have been torn down. The old mill building has been repaired. A new 12x10 Chicago Pneumatic air compressor has been purchased and delivered at the mine. Twenty 1,000-lb. stamps have been purchased from the old Lightner Mine at Angels and will be installed soon. It is proposed to extend the power line to the property, remodel the present hoist to electric drive, and build a concrete dam 140 ft. long across Cherokee Creek for the storage of water for use during the dry months. The shaft is 690 ft. deep. The mill will be operated on ore lying between the 600 and 400 levels.

Demarest Mine, Fourth Crossing, Calif.

Zinc Reported in the Old Rambler Mine, Wyoming

The first zinc mine in Wyoming has been opened at Silver Crown, according to an announcement by Albert Bartlett, State Geologist. The property is being opened by E. P. McCarty, manager of the Eagle Mountain Mining Co., which is operating the zinc mine, leased from John Morris. A small air-compressor plant has been installed, and the shaft of the mine, which is known as the Rambler mine, has been deepened, with the result of a good showing of zinc ore. Preparations are being made to install a concentrating plant. Small shipments will be made within six weeks.

Mohawk Averages 26 Lb. Copper per Ton of Rock

The Mohawk mine, Mohawk, Mich., is sinking in No. 6 shaft, its richest unit. Copper values have been uniformly heavy in the lower reaches, averaging about 28 lb. refined per ton, the richest in the history of the mine.

Sinking is about to be resumed in No. 1, the leanest unit, which is furnishing a small tonnage. In spite of the low yield from No. 1, the average for the entire mine is about 26 lb. With the building of new mineral bins at the stamp mill, the construction program will have been completed. The exterior of the mill was concreted this summer, making it a fireproof plant. According to report, the four regrinding units are making a good recovery of copper from the stamp tailings.

Federal Largest Producer in Joplin-Miami District

The Federal Mining & Smelting Co. continues to be the largest producer of zinc ore in the Joplin-Miami district. Apparently it will produce 70,000 tons in 1926. Its nearest competitor, the Eagle-Picher Lead Co., will produce close to 60,000 tons, and the Golden Rod Mining & Smelting Co., third in the list, about 45,000 tons.

A comparative table of production, showing the output of some of the leading companies of the district for the first ten months of 1926 and 1925, follows:

Joplin-Miami Production by Companies

Company	1926	1925
Federal M. & S Co.	64,927	59,126
Eagle-Picher Lead Co.	54,926	53,299
Golden Rod M. & S. Co.	44,338	38,032
Commerce M. & R. Co.	43,651	46,856
S. H. Davis, agent	37,757	36,692
Consolidated L. & Z. Co.	33,153	35,195
Skelton L. & Z. Co.	22,851	25,425
Kansas Exploration Co.	20,953	12,929
Anna Beaver M. Co.	20,946	17,321
New Chicago M. Co.	18,777	12,049
Childress L. & Z. Co.	17,355	11,771
Velie-Lion M. Co.	17,270	11,457
Cortez-King Brand M. Co.	16,243	14,222
C. F. Dike, agent	13,766	13,797
Barnsdall Zinc Co.	12,379	15,992
Butte-Kansas M. Co.	11,445	16,031
Admiralty Zinc Co.	10,794	13,008
Quapaw M. Co.	10,267	11,478
American Z. L. & S. Co.	10,180	7,495
Domada M. Co.	8,302	6,644
Huttig L. & Z. Co.	7,317	8,748
Commonwealth M. Co.	7,066	4,781
Rialto M. Co.	6,631	13,610
Bilharz M. Co.	6,313	8,247
Bosca M. Co.	6,280	7,030
Black Eagle M. Co.	6,223	7,851
Acme L. & Z. Co.	6,044	7,694
St. Louis S. & R. Co.	5,491	17,058
Dorothy Bill M. Co.	5,114	10,353
Vantage M. Co.	4,948	4,202

The Federal has closed down its Granby mine temporarily. The property has been producing about 10 per cent of the Federal's output in the Joplin-Miami field, or from 150 to 180 tons a week. P. W. George, manager, states that a large amount of development work will be done at the mine during the next three or four months.

Seventy-five Thousand Dollars for Research Work

To further research work in both iron and copper, the Michigan College of Mines, at Houghton, will ask the Michigan Legislature to appropriate a total of $75,000, to be used by the Geological Survey of the state and the college, divided as follows: The sum of $10,000 to the Geological Survey to publish its accumulated information; $15,000 per year to the Geological Survey to get new information needed to promote prospecting for iron and copper, and $50,000 per year to the Michigan College of Mines to develop methods of using Michigan low-grade iron and copper ores that are not now usable.

Heavy Rains Help Kootenay Mines

Recent heavy rains in the Kootenays have enabled several companies to operate mills that have been idle for several months, and consequently more material is reaching Trail in a concentrated form. The rainfall for more than eighteen months has been unusually light.

Bonanza Ore Reported in Red Top Mine

A strike of gold ore, typical of the bonanza oreshoots of Goldfield, Nev., is reported to have been made in a lease on the Red Top mine of the Goldfield Consolidated Mining Co., at Goldfield, Nev. The ore was found about 20 ft. below the surface and on the end line of the lease block. To develop it into the lease ground a shaft will be sunk from surface, and machinery and tools for this work are now being collected. The block covers an area 300 ft. by 400 ft. in plan, and extends to the 200 level of the Red Top mine workings. The lease was originally granted to Homer Barker, of Tonopah and Goldfield. He has turned over the lease to the Calumet Divide Mining Co., and this company, under Barker's direction, will proceed at once with development.

Colombian Company Adds Motor-ship to Its Equipment

According to *The Pittsburgh Post* of Oct. 31, a motor-ship has just started from Midland, Pa., about 30 miles from Pittsburgh, on the Ohio River, for the San Juan River, Colombia, South America, where she (the "Betty") will be used by the South American Gold & Platinum Co. The vessel is named after Miss Betty Lewisohn, granddaughter of Adolf Lewisohn, of New York. The boat is 82 ft. long, 6 ft. deep amidship, and has an 18-ft. beam. The propelling power is two 80-hp. Diesel engines. Fuel-oil good for 150 hours' running at 10 to 12 miles an hour is carried. The hold will stow 80 tons of cargo. There are quarters for a crew of six and accommodation for twelve passengers. The Midland Barge Co. is the builder.

In this connection it is of interest to record that the Dravo Contracting Co., Neville Island, Ohio River, near Pittsburgh, built one of the dredges now operated by the South American Gold & Platinum Co. It is of 1,100 tons' gross displacement.

The building of river craft in the Pittsburgh district is increasing each year, until the present consumption of steel for this purpose exceeds 50,000 tons a year.

Greene Cananea Announces Important Ore Discovery

W. D. Thornton, president of Greene Cananea Copper Co., in a letter to stockholders states the company has discovered in drill holes an important body of ore south of Capote basin considerably higher in grade than any within the company's other mines. He continued in part:

"It is felt that the stockholders should be advised that a discovery of importance has been made and that a shaft called 'La Colorada' has already been started to develop this section and determine as soon as possible the extent and value of the discovery. If no unforeseen difficulties are encountered it is expected that the shaft can be sunk and a crosscut extended to the ore by about a year from the present time and production started very soon thereafter."

Guanajuato Mines Suspend

On Oct. 26, the Guanajuato Consolidated Mining & Milling Co. gave the Mexican government the one month's notice required by law of its intention to suspend operations. The decision of the company to shut down is directly the result of the recent drop in the price of silver, which has rendered quite unprofitable the company's ore reserves, always of low grade. Dr. Alfred Wandke, the general manager, announces that it is hoped that the shutdown will not be permanent, as the company intends to maintain everything in first class condition, ready for the resumption of operations as soon as the price of silver permits.

On Oct. 28, the Guanajuato Reduction & Mines Co., for the same reasons actuating the Guanajuato Consolidated, gave the government notice of its intention to close down its La Luz unit.

The news that the two plants mentioned above are to be shut down came as no surprise to anybody in the camp. Indeed, people are wondering how long the other mills can be operated should silver take no turn for the better.

The other mining companies of the camp continue to operate at full capacity, and their managements hope, by increased economies and co-operation on the part of the men, to be able to pull through the present crisis.

The employees and men of the Cubo Mining & Milling Co. have agreed, from the general manager, Irving Herr, down, to accept a 10 per cent reduction in their salaries and wages to help keep the company on an operating basis.

Mineral Production of North Carolina $10,000,000 per Year

Utilization of clay products has greatly increased the value of minerals produced in North Carolina in the last decade, according to a report just made by Dr. J. L. Struckey, formerly State Geologist, to the Department of Conservation and Development. The value of North Carolina minerals of this nature is still very low, amounting to only $10,163,435 in 1924, the last year for which the state's figures are available. The greatest value, Dr. Struckey said, is the potential uses to which the native clays and shale may be put. Investigations are now being made of the possibilities of using these materials for fireproofing purposes.

Pipe-Line Statistics

Financial and operating data of 37 pipe-line companies reporting to the Interstate Commerce Commission for the calendar year 1925 follow:

Miles of pipe line operated	70,009
Oil transported, bbl.	831,199,821
Number of employees	20,693
Investment in pipe lines	$511,087,922
Other investments	93,896,176
Cash	13,448,749
Material and supplies	13,004,677
Total current assets	88,274,640
Capital stock	321,485,100
Unmatured funded debt	24,483,000
Total current liabilities	13,126,522
Accrued depreciation	193,852,944
Total corporate surplus	102,190,113
Pipe-line operating revenue	164,644,740
Pipe-line operating expense	20,231,636
Tax accruals	13,397,559
Net income	88,495,026
Dividends	72,200,356
Employees' compensation	34,626,344

Treadwell-Yukon Active in Tybo Area

The Treadwell-Yukon Co. has recently taken an option on the old Rattlesnake property, 7 miles north from Tybo, in Nye County, Nev., and a definite development campaign has been outlined. The Rattlesnake mine is an old one, on which a considerable amount of small work has been done. Values are principally in lead, with some silver and zinc. The fact that the mine is 70 miles from a railroad has delayed its development.

This makes the third property in the Hot Creek mining district upon which the Treadwell-Yukon Co. has obtained options and is doing development, the others being the "2G" and the Dimmick, adjoining properties. The development work will be under the supervision of W. H. Blackburn.

Silica Sand to Be Produced at Las Vegas, Nev.

The Nevada-Pacific Minerals Co., incorporated under the laws of Nevada for $200,000, with offices at Las Vegas, Nev., was organized recently for the purpose of producing silica sand. The company owns 640 acres of silica sand in Nevada near Las Vegas on the Los Angeles & Salt Lake branch of Union Pacific Railroad. Exposed deposit contains high-grade sand. The sand in formation and character of grain (being round grain) is the same as the silica sand at Ottawa, Ill. Practical tests of the Nevada sand made in steel foundries and glass plants over a period of four years have proven the sand entirely satisfactory for their respective uses. Actual tests have definitely proven that flint glass made from this deposit is absolutely colorless. Plans are being drawn for the immediate construction of a 100-ton plant at the deposit. The company has taken over the molding sand properties and plants of the Mineral Supply Co. at Riverside, Calif. The plant near Riverside produces a light molding sand suitable for small gray iron, brass, and aluminum castings and has a capacity of 100 tons per day.

Union Carbide Buys Vanadium Company

The Union Carbide & Carbon Corporation has exercised an option to purchase the entire assets of the U. S. Vanadium Co., effective as of Dec. 1. The Carbide company has been negotiating for and developing the orebodies and processes of the Vanadium company for the last year.

This property is at Rifle, Garfield County, Colo., 300 miles west of Denver. The ore is mined about 12 miles from Rifle and hauled from the mine to Rifle for treatment. The U. S. Vanadium Co. has also a smelting plant at Columbia, Ohio, and has furnished one of the highest grades of ferrovanadium that is on the market. Sales of both the oxide and the ferrovanadium will be handled by one of the subsidiaries of the Union Carbide & Carbon Corporation, the Electro Metallurgical Sales Corporation.

News From Washington

By PAUL WOOTON
Special Correspondent

Application for Tungsten Tariff May Be Withdrawn—Bismuth Prices Controlled by Europe—Potash Legislation

WITHDRAWAL of the recent application for an increase in the duty on tungsten is expected. Domestic producers are said to fear that the opening of the question at this time might result in a reduction rather than an increase.

It is known that there is a strongly held opinion on the part of some administrative officials in the government service that our limited reserves of tungsten should be preserved against another day when we might be cut off from foreign sources of supply. If the matter of changing the rate of duty should come up it is expected that such a point of view would be stressed.

Practically all cases which have come before the President have resulted in increases in the duty. This has given rise to some criticism. Some think the President would welcome an opportunity to reduce the duty on some commodity, just to demonstrate that the flexible tariff works both ways.

The producers are said to recognize that they are few in number and without resources as compared with the consumers of tungsten. As a consequence the producers fear that action on an application to increase the duty simply would provide an opportunity to make a case for a reduction in the duty.

Bismuth Prices

In connection with its studies of raw-material controls, the government is gathering data on bismuth. Though the American requirements for this metal are met largely from the by-product output in this country, the price is controlled in Europe.

Increasing use of low-melting-point alloys and the expansion of chemical manufacture are making bismuth a more important material. The control is not difficult because of the few large deposits of the metal. Independent production from small deposits has been discouraged in clever ways, it is declared. If an independent cargo is shipped the price frequently collapses at about that time, it is declared. Certain consumers complain that they are penalized if they purchase bismuth which has been produced by others than those who are parties to the international understanding. Other practices intended to stifle competition have been reported.

Potash Legislation

Legislation which will permit the University of Texas to co-operate with the Federal Government in its potash explorations is expected in the near future. Because of the legal difficulties which have arisen in connection with the proposed reimbursement of the government by land owners, it may be possible to arrange for drilling on university lands.

The Interior Department has announced that the Geological Survey has received from its field men in New Mexico, Texas and Utah important information concerning potash—that a number of potash minerals have been found which afford increasing evidence of the similarity of American deposits to the famous deposits in France and Germany.

The quantitative information necessary as a basis for commercial exploitation of the American potash deposits can be obtained only by core drilling. Fortunately, public interest in the commercial possibilities of these beds is increasing, private organizations are making core tests at different points, and whenever possible the government is co-operating with these organizations.

Chemical experts of the Soviet Government declare that the monopoly of Germany and France in potash production will soon be broken. In the Solikamsk district, in the western part of the Government of Perm, Ural Mountains, an area of potash-bearing land thirty miles square has been discovered. The deposits in this area are only 300 ft. below the surface.

Reclamation Work at the Barnes-Hecker Mine

The work of recovering bodies and reclaiming the Barnes-Hecker mine of the Cleveland-Cliffs Iron Co., Ishpeming, Mich., where 51 miners lost their lives Nov. 3, is proceeding satisfactorily, but the utmost caution must be observed to safeguard the rescue crews, which are working in three shifts. Seven bodies were removed from the workings on the day of the accident and three more were found in the shaft on Nov. 9. It is unlikely that any of the remaining 41 can be reached for some time.

The damaged shaft has been cleared and repaired to the first or 600 level. The cave, which rapidly filled with surface water, is being dewatered by two large electric-driven pumps. When this water is down there will be less danger for the workers in the mine, and little can be accomplished underground until this condition prevails in the caved area.

It is estimated that about 200,000 cu.yd. of sand and rock went into the workings with the crash. The mine had produced 405,000 tons of iron ore in its three years of mining, and considerable rock had been taken from the footwall drifts. The general opinion of mining men is that practically all of the workings, with the exception of the shaft above the first level, are filled. The task of reclaiming the mine is a tremendous undertaking, but President W. G. Mather has ordered that every body be found and the mine placed in condition for ore removal. Plans are now being made to concrete the bottom of the cave to prevent further sand runs.

The Cleveland-Cliffs company has stated that the maximum compensation will be paid in every case. Also, the county mine inspector, William E. Hill, who met his death in the mine, will be considered as an employee and his widow will receive compensation. Elective officers in Michigan are not entitled to the protection of the compensation laws. The welfare department, which is under the direction of W. H. Moulton, is doing everything possible for the families of the victims.

The work at the mine is in charge of C. J. Stakel, superintendent of the North Lake district for the Cleveland-Cliffs, with J. H. Rough, head mining captain for the company, assisting. The three shifts in the shaft are in charge of Captains Joseph Thomas, of the Nagaunee mine; John Tregonning, of the Athens mine, and William Olds, of the Cliffs Shaft mine, all of whom are experienced shaft men and long in the company's service. There is much work for the mechanical and electrical departments to do.

The Morris side of the Morris-Lloyd mine has been closed for the time being, and the men who were employed there constitute a night shift at the Lloyd. Three bulkheads have been constructed on the bottom level of the Morris, which is connected with the Barnes-Hecker by a 186-ft. raise. The two mines are over a mile and a half apart.

L. P. Barrett, State Geologist of Michigan, has completed a visit to the mine and gone over the maps and reports of the company pertaining thereto. Upon completing his examination he issued the following statement:

"The precautions taken and mining methods used were such that there was no reason to suspect it possible for such a catastrophe to occur. In short, the officials of the Cleveland-Cliffs Iron Co. took all possible precautions to insure the safety of their men and no blame can be attached to the company or to any individual for what occurred."

Kennedy Mine Completes Electrical Installation

The Kennedy Mining & Milling Co., Jackson, Calif., has completed the changing of its steam hoist to a motor-driven hoist. The steam hoist is left intact for emergencies. Departments of the surface plant at the mine are now equipped for electrical operation. An additional air compressor is also being installed. A steel headframe to replace the present wooden structure is being designed.

Calumet & Hecla Saves on Transportation Costs

Calumet & Hecla, Calumet, Mich., is transporting all copper rock and supplies over its own tracks, the company having recently taken over the Mineral Range tracks north of Kearsarge and between Calumet and Tamarack mills. This was the final step in concentrating haulage on its own railroad, which will result in further saving of costs.

Toronto Letter

By Our Special Correspondent for Northern Ontario

Additional Power for Kirkland Lake Soon—More Copper Discovered in Rouyn Area

At the Castle property, in Gowganda, production is being maintained at the rate of about 85,000 oz. a month. The lower price being obtained for silver is being offset by a reduction in costs. Last year Castle costs were approximately 40c. an ounce, and an average of 68c. an ounce was being received for silver. At present costs have been reduced to 34c. an ounce, which at current prices for silver indicates a profit of approximately 20c., as compared with 28c. in the preceding year.

To meet the growing demands for power in the Kirkland district, the Power company proposed to re-wire one of the transmission lines from Cobalt to Kirkland. This is expected to double the capacity of the line. In addition to this, during the coming winter a line will be built to Kirkland from the Indian Chutes plant of the old Great Northern Power Co. It is also expected that eventually provision will be made to utilize the power from the Quinze. This is 25 cycle, while Kirkland Lake uses 60 cycle power and a cycle changer will be necessary.

At the Towagmac property, in Rouyn, a crosscut being driven to cut the main orebody intersected another vein which showed 5 ft. of ore carrying approximately 6 per cent copper and about the same percentage of zinc. This would appear to be either a new vein or an offshoot of the main vein, which should be intersected by the crosscut a little further to the north. A new discovery has also been made on the Montbray properties, under option to the Nipissing. Deep trenching has proven an extensive mineralized zone, in which at least one 4 to 5 ft. width of rich copper ore has been located. This is believed to be the most important discovery made to date on the Nipissing holdings in Quebec.

Work has been started on the properties of the recently formed Keweenawn company, of Cobalt. A diamond drill is being operated to determine the thickness of the conglomerate at several points as a guide for shaft sinking. A mining plant has been ordered and the necessary buildings are being erected. The shaft, when started, will be put down to the contact and exploration carried on from that point.

Central Manitoba Plans Future Development

H. A. Wentworth, president of Central Manitoba Mines, Ltd., and Thomas Pryor, engineer for John Taylor & Sons, have returned from the Long Lake district to Winnipeg, and with T. C. Anderson, local director of the company, have left for the East to attend a directors' meeting of the company at Toronto and Boston, where the entire procedure for the coming year of the company is to be decided.

Both Mr. Wentworth and Mr. Pryor expressed themselves as pleased with developments. This section of the WAD zone is shown by recent study to be very attractive, having what appears to be four parallel shear zones within a width of 800 ft. in all of which commercial ore has been exposed.

Location of the mill has been decided upon, tentative plans have been made for the power line into the district, and at the directors' meeting the decision as to the size of the first mill unit will be reached. The final mill tests, which have been under the supervision of Henry Hansen, of Toronto, who built the mill for the Dome Mines, are out, and indicate a recovery of 95 to 97 per cent of the gold, comparable to the best mill recoveries in Ontario.

Cork-Province Reorganizes

The annual report of Cork-Province Mines, Ltd., Kaslo, B. C., for the fiscal year ended June 30 last, shows that the company made an operating loss of $2,915.85, without providing for interest on debentures, amounting to $5,920. The balance sheet shows a debit of $33,507.73. Sales of ore and concentrates amounted to $34,196. Except for a small part of the year, the power plant is unable to keep the mill in operation, and the mill requires remodeling to bring it up to modern standards.

The company sets forth a plan for reorganization. It proposes to issue 250,000 preferred shares at a par value of $1 each and 3,000,000 common shares at a par value of 25c. each. Bond holders are to receive preferred shares to the value of their bonds and accrued interest, totaling $90,000, and the stockholders are to receive one share of the new stock for each share of the old, totaling 1,500,000. This will leave in the treasury 160,000 preferred and 1,500,000 common shares, which are to be sold to provide money to continue development. It is understood that arrangements have been made for the underwriting of all the treasury stock at a price that will assure the company $120,000.

Big Ben Consolidated Mine, Lincoln Calif.

Big Ben Consolidated Has 115-Ft. Headframe

The extreme height of the headframe over new shaft on the Big Ben Consolidated, Lincoln, Calif., was deemed necessary owing to the flatness of the country adjoining the shaft, and the desire of the management to have sufficient height (115 ft.) in the headframe to provide for ore storage and gravity flow through a 20-stamp amalgamating and concentrating mill which is to be built later. The hoist is a double drum, electrically driven, 112 hp., built by the Vulcan Iron Works, and the hoisting speed is 800 ft. per minute.

State vs. County Mine Inspection

L. P. Barrett, Michigan state geologist, announces that legislation will be pushed at the next session of the legislature to prevent catastrophes similar to the one which snuffed out 51 lives at the Barnes-Hecker mine on Nov. 3.

Mr. Barrett has made an inspection of the Barnes-Hecker mine, and states "that in his opinion the officials of the Cleveland Cliffs company, owners of the mine, did everything humanly possible to prevent such a disaster, and that it was wholly unfortunate and unforeseen. I am of the opinion that new legislation should be passed, putting all mines in the state under the direct supervision of college-trained state inspectors.

"Obviously, a trained and experienced technical state mine inspector can do infinitely more toward averting such disaster than an untrained county inspector who generally, under present conditions, is merely an examiner with no experience in geology."

Tonopah-Canadian Acquiring Additional Property

An important mining transaction is pending in Gowganda, involving a number of mining claims in the Leroy Lake section of the Gowganda district. The prospective purchaser is the Tonopah-Canadian Mining Co., operating at the Walsh and Morrison properties. According to available information, the transaction involves a group of claims owned by Leroy Lake Syndicate, as well as a group owned by Leroy Lake Mines. The claims in question are along the upper side of the diabase sill and embrace at least a part of the Keewatin "bowl."

Hudson's Bay Company Claims Minerals in Post Lands

Through agreement between the Federal Government of Canada and the Hudson's Bay Company, there is in preparation a series of questions to be submitted to the Supreme Court of Canada to determine the ownership of the precious metals found on lands owned by the Hudson's Bay Company throughout Canada.

Melbourne Letter

By Peter G.Tait
Special Correspondent

Government Ownership of Mines Failure in Queensland—Interest Shown in Tasmanian Tin Areas

Melbourne, Oct. 18—An official report from New Guinea in regard to the Edie Creek field states that as a result of six weeks' work starting on Aug. 1, 10,000 oz. of gold has been exported. This does not necessarily represent all of the production, and although the official statement is silent on this point, it is believed that considerable quantities of gold are being retained by the producers owing to the difficulties and dangers of transport. Salamaua, the nearest coastal port, is 50 miles from Edie Creek, and the journey necessitates continuous travel for seven days. Numerous restrictions are placed on prospectors by the government, primarily for their own safety and to ensure protection for the natives. No stores or supplies are available on the field, and this necessitates prospectors taking a large store of provisions. The nearest port for customs and quarantine purposes is Rabaul, 500 miles from Salamaua. It has been stated that a prospector must obtain 5 oz. of gold per day to cover his expenses.

The experience of the state of Queensland should be a warning to any government tempted to start out as mine owners and operators. In fact, Queensland can furnish examples in other fields as to the dangers of the socialization or nationalization of in-industry, i.e., the cattle stations and butchers' shops which were intended to grow and distribute cheap meat. Certainly cheap meat was sold, but the country had to meet the loss. Some years ago after the Chillagoe company had come to the end of its resources the government stepped in to show how the mines and treatment works ought to be run. To the end of June operations have been responsible for a deficit of about £1,000,000, say $5,000,000. Certainly the government still possesses the "assets." The government also operates treatment works (tin) at Irvinebank, on which the accumulated losses amounted to £41,610. The Jibbenbar arsenic mine tells the same story, with an accumulated loss of £15,886, but, as a set-off against this, cheap arsenic has been supplied to horticulturists for eradicating the prickly pear. Queensland possesses wonderful deposits of coal, and as private colliery proprietors were not developing the mines quickly enough, the government opened up mines at Bowen, Baralaba, and Styx River. Then the government purchased the Mount Mulligan colliery from the Chillagoe company, primarily to supply fuel for the northern railways and coke for the Chillagoe smelters. The total liability of the state mines stands at £67,051. A consideration of these facts leads to the conclusion that it is better to encourage private enterprise, and, if necessary, to subsidize it, than for the government to take the risk. All experience leads to the conclusion that, if private enterprise cannot see any prospect of a return, the chances of a government doing so are still more remote.

Hoskins Iron to Expand

The Hoskins Iron & Steel Co. is raising £300,000 of additional capital for the purpose of extending its operations to Port Kembla, where a large area of freehold ground is held. The fact that there are two iron and steel works in Australia is sometimes overlooked. Messrs. C. & G. Hoskins, engineers, acquired the Lithgow plant from W. Sanford in 1907, and their enterprise represented the first successful attempt to establish the iron and steel industry on a commercial scale. The plant has a capacity of 3,500 tons of pig iron per week. All grades of foundry iron are produced, as well as steel blooms and billets for varying requirements, including the rolling of railway rails. In addition to the iron-ore deposits being worked in New South Wales, the company holds large deposits in Tasmania and Western Australia.

Federation Tin Flotation

The high price and favorable outlook for tin are factors which have helped the flotation of the Federation Tin Mines, Ltd., in London. The new company, which has a nominal capital of £200,000, has issued 110,000 shares of 20s. each. The Melbourne company will receive 66,500 shares and £16,000 cash. The property is situated at Heemskirk, on the west coast of Tasmania. J. B. Lewis, mining engineer, reporting on it in 1920 stated that 57,700 tons of ore had been proved and that the probable ore was 450,000 tons. A 60 head battery was purchased, but not erected, owing to lack of funds.

Another tin lode area attracting attention is the Renison Bell field adjoining the Emu Bay railway on the west coast of Tasmania. A. Victor Leggo, of Melbourne, has had a staff at work testing the Renison Bell, Montana and Dreadnought Boulder mines. The promoter intends to consolidate the properties, which have previously been worked by separate companies, and to conduct operations on a large scale.

Alaska Juneau in September

September operations of the Alaska Juneau showed the largest tonnage yet attained. In all, 345,300 tons was mined and trammed to the mill, yielding $183,500, or 53.14c. per ton, at a cost of $154,700, or 44.80c. per ton. Operating surplus was $28,000, or 8.34c. per ton. Other expenditures and accrued charges tofaled $37,000, leaving a deficit of $8,200 for the month.

North Butte to Develop 2,200 Level

According to present plans of the management of the North Butte Mining Co., Butte, Mont., active work underground will start at its east side properties before the end of November. Heavier pumping equipment will be installed and the 2,200 level driven to tap the orebodies encountered east of the Continental fault on the 2,000 level.

Metal Production in Eastern States

ACCORDING to the U. S. Bureau of Mines, the mine production of gold, silver, copper, lead, and zinc in the Eastern states in 1925 was valued at $22,068,792, which is 11 per cent more than the corresponding value in 1924. Of this total value gold represented $40,612, silver $73,722, copper $2,957,016, lead $465,798, and zinc $18,531,644. Production of all metals increased in quantity and value, and the larger lead, zinc, and copper mines were operated steadily to take advantage of the higher prices for those metals in 1925. The quantity of ore treated increased 16 per cent.

Gold Discovery Reported in Slate Lake Area

Much interest has been aroused among mining men by recent discoveries of gold in the Slate Lake section of Lake Du Bonnet district of northern Manitoba, only a short distance from Long Lake and Bull Dog Lake. One of the veins has been traced for several hundred feet. The vein has a width of 28 ft. in places and one section has a width of 40 ft.

Golden Rod Mill Destroyed by Fire—A New Type of Crusher

The Golden Rod Mining & Smelting Co.'s No. 27 mill, two and one-half miles southeast of Picher, Okla., was destroyed by fire Nov. 9, with an estimated loss of $100,000, part of which was covered by insurance. The origin of the fire is unknown. It was discovered about 7:30 in the evening, but was then under such headway that it could not be controlled by the Picher fire department. The mill formerly was known as the Hope, and had a capacity of about 300 tons.

The Lucky Jenny mill, in the Joplin-Miami district, is being rebuilt by Fred Childress and associates, who took over the property several weeks ago. The mine had been optioned first to the Kansas Explorations Co., which decided to turn it back. Childress then obtained his working option, and closed it after proving to his satisfaction that the property is worth further development.

A new type of crusher is being tried out by the Semple Mining Co. and the Tulsa Lead & Zinc Co. in the Joplin-Miami district. It takes the place of the first set of rolls under the primary breaker. It is also believed it may prove superior in doing the work of the secondary rolls, and that it will save sliming, to some extent.

At the plant of the Tulsa company this new crusher is of 36x9 in. size. The jaws are of steel with V-shaped corrugations. The one bumper gives a crushing blow and a grinding motion, and experiments are being made with sectional jaws to eradicate waste of material.

Johannesburg Letter

By John Watson
Special Correspondent

Transvaal Gold Production £3,567,834 in September—Platinum Plant to Be Increased

Johannesburg, Oct. 12—The following results of crushings, for the month of September, from fourteen leading Rand gold mines, have recently been published. The mines are arranged in order of profits earned:

	Tons Crushed	Value or Revenue	Costs per Ton s.	d.	Estimated Profit
Government Areas	200,000	£385,057	16	2.4	£225,250
New Modder	129,000	287,248	18	1 8	170,157
Crown Mines	215,000	302,028	19	7.3	91,227
Modder Deep	44,200	115,768	15	3.0	65,835
Springs	68,500	128,261	19	1.0	62,909
New State Areas	76,000	131,124	20	4.9	54,132
Brakpan	84,500	130,998	19	1.6	50,164
Van Ryn Deep	69,500	104,475	15	10.8	50,121
Modder B	68,000	108,533	17	11.4	47,513
Geduld	80,500	115,768	17	1.0	47,119
Randfontein Estates	187,000	206,865	18	11.0	32,125
West Springs	50,300	78,000	18	4.3	31,832
City Deep	96,500	142,360	23	2.1	30,537
Robinson Deep	76,000	.....	18	1.5	28,890

The output of gold for September was declared on Oct. 9 by the Transvaal Chamber of Mines at 839,939 oz., having a value of £3,567,834. Compared with August, these figures show a decrease of 3,915 oz. and £16,630 in value. The native labor returns show 185,063 "boys" working Sept. 30 on the Witwatersrand gold mines, an increase of 1,031 compared with Aug. 31.

Lydenburg Platinum, Ltd., has acquired the mineral rights on the farm Waterval No. 537, in the Rustenburg district. A new company has been registered with the title Waterval (Rustenburg) Platinum Mining Co., Ltd., with a nominal capital of £250,000 in £1 shares. M. Weber has recently reported on the property and says milling tests made lately in Europe for Dr. Merensky on Waterval ore gave excellent concentration results. It is estimated that the explored block contains 2,000,000 tons of high grade ore, which should be easily worked, according to M. Weber.

Lydenburg Platinum Areas, Ltd., reports highly satisfactory values from recent development work on Maandagshoek, Mooihoek, and Driekop. The pilot plant on this section was started on Aug. 16 last and the results are so satisfactory that the capacity of the plant is to be duplicated. For the present, the company will confine operations to the three forms mentioned and defer operations on Dwars River.

In the *Star*, of Johannesburg, of Sept. 27, we learned that Colonel Creswell, Acting Minister of Mines, had informed the Pretoria representative that Sir Robert Kotze would retire from his position of Government Mining Engineer on Oct. 31. Next day, it was stated that the rupture had occurred through the question of the appointment of a successor to J. A. Vaughan, chief inspector of machinery. Sir Robert Kotze has been Government Mining Engineer for eighteen years and has filled the post with conspicuous ability and tact. In this case, Sir Robert as a matter of principle takes the stand that he should be best fitted to judge who is to succeed to the post of technical mechanical adviser in his department.

Johannesburg Consolidated Investment Co., Ltd., issued last week the directors' report, to be submitted to shareholders at the annual meeting on Nov. 30. This report shows a profit for the year of £743,538. The directors refer to the acquisition of a controlling interest in Potgietersrust Platinums, Ltd., and they are satisfied that there will be established in South Africa a permanent platinum-mining industry of great value, this company promising to be the most important producer. P. P., Ltd., controls large areas of ground, and the deposits are wide and of good grade. Working conditions are excellent, there being a plentiful supply of water. Since the company took over the engineering control, development has been highly gratifying. A trial reduction plant is in course of erection and should be working at an early date.

From Onverwacht, Ltd., the sales of refined platinum effected up to Sept. 28 totaled 1,875 oz.; the net amount realized totals £35,186, equal to an average of £18 15s. 4d. per ounce. In addition to the above sales figures, the crude platinum still in transit is estimated to contain 2,278 oz. of platinum and allied metals.

On the Johannesburg Stock Exchange during the last week the market was active, chiefly through London orders both for buying and selling. Gold shares remained steady on the whole. T. C. Lands were quiet during the week, and Onverwacht platinums improved from 17s. to 18s. 9d.

Haiti Mines Co. Developing Copper Property

The Haiti Mines Co., 95 Broad St., New York City, is developing a mineral concession on the Island of Haiti. Mineral areas have been known and worked intermittently since the discovery of the island by the Spaniards. Many old mine workings are still to be found.

During the period 1906 to 1911 the present owners of this concession shipped about 4,000 tons of copper ore to smelters on the Atlantic coast, but the cost of transporting the ore by burro trains over the rough mountain trails prevented further shipments. Within the last year development work has been resumed on outcrops 10 to 15 miles from the sea coast. About 120 men are employed.

Tax Reduction on Silver Approved in Mexico

The President of Mexico has approved a decree providing for a progressive diminution of silver taxes when the price of that metal falls below 57c. per ounce, states a cable to the U. S. Department of Commerce. The constant rise of dollar exchange is reported to be exerting an adverse effect on markets and collections in Mexico.

London Letter

By W. A. Doman
Special Correspondent

Drop in Tin Price Not Regrettable —Rhodesia Again to the Front

London, Nov. 2—Tin has suffered a nasty tumble in price, having come down from £306 2s. 6d. per ton to £296 10s. This drop has had a corresponding reflex on the share market, for everything, almost without exception, is quoted lower. From one standpoint this is not to be regretted, as a heavy bull account had been built up and the position was becoming unhealthy. Speculators get nervous when they see prices going against them, for they have a natural dislike to paying out differences. Investors who have paid for and taken up their shares do not worry, as prospects have not changed in the least. The demand for the metal must grow; buyers cannot hold off for long, and supplies cannot be increased to any extent. Producers cannot hold their stock indefinitely, as doing so is too costly. The fall in the price of the metal is due to buyers holding aloof in the hope of reaping an advantage. It seems that wherever a speck of tin is found someone is ready to form a company to exploit the deposit. The latest discovery is that in Uganda. A company called the Ankole Tinfields has been formed, with a capital of £100,000, in 5s. shares, to develop tin, lead. wolfram, and other mines. The vendors are the Tanganyika Goldfields.

Rhodesia has been much to the front within the last few days, the British South Africa Company itself being prominent. This corporation has made a departure, and has appointed the Anglo-American Corporation of South Africa its consulting engineers in Northern Rhodesia for a period of two years. The corporation is already interested in the country, and clearly the arrangement would be to the benefit of both. On several occasions the charge has been made against the Chartered company that it did not pay sufficient attention to the mineral possibilities of its territory. Presumably the copper discoveries during the last few years, and the concessions applied for, have awakened the management to the fact that the company could get a larger share in the country's mineral wealth.

I have previously mentioned the N'Changa copper deposit belonging to the Rhodesian Congo Border Concession. This has opened up in such a manner that it is now floated as a separate company with a capital of £600,000.

The Globe & Phoenix (Rhodesia), which for many months has been regarded as a dying mine, owing to the low grade of ore opened up in the deepest levels and the reduction in the ore reserves, has suddenly come to life again, and the 5s. shares are quoted at 18s. 9d. No one seems to know definitely what has happened in the mine, but unofficial cablegrams refer to the strike of a rich body of ore on the Parallel Reef, assaying several ounces to the ton.

Spanish Mines Topic at New York Meeting of A. I. M. E.

Kemp Tells of Side Trips at Recent Geological Congress—Rickard Refers to Antiquarian Studies

EVIDENTLY those who attended the geological congress in Spain last summer had a most interesting time from the technical standpoint, as well as being the recipients of a full measuse of Spanish hospitality in a social way, judging from the impressions one gained from Prof. James F. Kemp, T. A. Rickard, and H. Foster Bain, in their remarks before the New York section of the A.I.M.E. at the Machinery Club last Monday night. J. E. Spurr was chairman.

The papers read at the Madrid meeting were presented in many different languages, said Professor Kemp, so that one had to be a linguist to follow all that was going on, though French was perhaps the most popular medium of expression. But it was of the side trips to various famous Spanish mining districts that "Uncle Jimmy" devoted most of his talk. The Almaden quicksilver mine, he was surprised to find, was five miles from a railroad; it is a night's run south and a little west of Madrid. Most of the ore is mined by hand drilling, though one compressed-air drill had found its way down to the 13th level, about 1,000 ft. below the surface. Apparently one reason for the non-adoption of modern labor-saving machinery is that jobs must be found for a large number of men, who, with their progenitors, have always lived in the district. Should one of them be discharged the rest would strike, it is believed. The occupation of the miners is not a healthful one, as Dr. Bain pointed out in subsequent remarks; a man will average only about eight 4½-hour shifts a month, and his useful life is only about fifteen years.

The Almaden ore, a new vein of which is in reserve, is raised to the sorting floor and broken by sledges. It will average from 6 to 8 per cent mercury, in the form of cinnabar. It is mixed with from 4½ to 5 per cent of coal and roasted in furnaces similar to lime kilns, thus driving off the mercury and sulphur. The mercury vapor condenses in the flues and is caught on the walls of small pear-shaped vessels of clay, called "aludels." These are removed to a sloping floor and the mercury is poured out or scraped from the walls, and allowed to run down into gutters, from which it is conveyed to a building for confinement in iron flasks. The stoppers of these flasks must be screwed in with heavy wrenches so as to make a particularly tight joint.

The Linares lead district was next briefly described by Professor Kemp. The veins of galena, only slightly argentiferous, occur in Cambrian quartzite, with large intrusive masses of granite at places. Three or four days were spent in this district. The mill practice appeared creditable, with good recoveries by modern methods.

The party then proceeds to Huelva, in southwestern Spain, on the coast near the Portuguese border, to the north of which are the copper and pyrites mines of Rio Tinto and Tharsis. These are largely worked by open-cut methods, though there is some underground development. The Tharsis company is operating only its Calañas mine. The pyrites is inclosed here in a wall rock of slaty carboniferous material. At the Tharsis mine there are four orebodies; it is planned to reopen this when the market for pyrites for acid-making is better. There is practically no copper in the ore.

At the Rio Tinto mines, to the east, the ore is a copper-bearing pyrite, enriched to a considerable extent in some places. Steam shovels are beginning to be used in the open pits. After mining, the ore is weathered in heaps for seven years, opening being provided for the admission of air and water sprays being used to prevent undue accumulation of heat. The copper-bearing water emanating from these heaps is passed over scrap iron to precipitate cement copper; the residue, containing about 48 per cent sulphur, is shipped to acid works. In the Rio Tinto mine it has been found that the rate of oxidation of the pyrite in place is about one foot per century, based on the weathering that has taken place in open faces left at the time of the Visigoth invasion.

From Oviedo, in the northern province of Asturias, visits were paid to the coal districts. Farther to the east, near the French border, the iron mines of Bilbao proved interesting. These deposits are in Cretaceous limestone, the brown iron ore running from 55 to 60 per cent iron. One mine is right at Bilbao, another important one being about 10 miles away.

Professor Kemp had many interesting lantern slides to illustrate his talk; some were of pictures made twenty years ago by Colonel Dwight.

T. A. Rickard, who has been studying the early records of mining at the British Museum for the last three months, and who is in New York for a few days en route to San Francisco, made a few introductory remarks regarding his work in the realm of archeology, enlivened by a story or two in lighter vein. He mentioned the enormous deposits of Roman slag in the Rio Tinto district, amounting to close to twenty million tons. Assays show some of this to contain about 0.3 per cent copper and 1 per cent lead, and Mr. Rickard thought it likely that the Romans smelted the ore for its silver content rather than for copper.

The meeting was preceded by the usual monthly dinner, after which a few changes in the bylaws were adopted, and a decided sentiment was registered against continuing the uptown meetings at the Harvard Club. It was not certain, however, whether this was because the Harvard Club had increased its dinner fee from $2 to $2.50, or because it was felt that some place should be selected to which a Princeton man would be willing to go.

St. Louis Section A.I.M.E. Holds Meeting at Bonne Terre

The St. Louis Section of the A.I.M.E. held its fall meeting on Nov. 5 at Bonne Terre, Mo., in the Southeast Missouri lead district. The members met at the office of the St. Joe Lead Co., where C. J. Adami, general manager, and J. H. Steinmesch, superintendent of the Desloge Lead Co. and chairman of the section, took charge of the party. The Nos. 11 and 17 shafts of the St. Joe Lead Co., in Flat River, were visited, where three types of loading machines were seen in successful operation. Their adoption has cut in half the former heavy expense of hand shoveling. The underground haulage is now performed by trolley motors on 56 pound rails, replacing mules and compressed-air locomotives.

After luncheon at the Y.M.C.A. building, which was provided by the three operating companies, the party went to the No. 2 Doe Run mill (5,000 tons' daily capacity), where differential flotation is used to extract a small amount of zinc. The ore on the western side of the lead belt carries more or less zinc that was formerly lost and which this mill is saving to the extent of about three cars a week.

In the evening over 100 members and guests assembled at dinner, where D. W. Brunton, of Denver, Colo., gave an informal talk that was followed by Messrs. P. N. Moore, Arthur Thacher, Professor McCourt and other members of the section, with Mr. Steinmesch as toastmaster.

On the following day some members visited the other mills and mines, while another party went to the Iron Mountain iron mine, where they were entertained by Superintendent Corbett.

American Association of Petroleum Geologists Meets in New York

The oil possibilities in foreign countries was the chief topic of discussion at the mid-year meeting of the American Association of Petroleum Geologists at the Hotel Pennsylvania, New York City, Nov. 15 to 17. Oil fields of virtually every nation in the world were reviewed by geologists prominent in both domestic and foreign fields.

The papers presented on Monday afternoon, Nov. 15, related to the oil fields of Venezuela, Colombia, and Russia. Tuesday's sessions were devoted to oil fields of Siam, China, New Zealand, Peru, Spain, Palestine, Egypt, and Canada. The papers read on Wednesday gave data on oil fields and production of Australia, Japan, Argentine, Ecuador, Mexico, Central America, and Poland. About 150 members and guests registered.

On Tuesday afternoon and evening no technical sessions were scheduled, the evening being given over to a banquet at the Pennsylvania Hotel.

The headquarters of the association have been established at Tulsa, Okla., with J. P. D. Hull as business manager. The annual meeting will be held at Tulsa, March 24 to 26, 1927, at which time will be presented a symposium on oil-field structures.

People You Should Know About

William B. McKinlay is back in New York.

Colonel William Boyce Thompson has left Superior, Ariz., for Palm Beach.

J. J. Beeson, Salt Lake consulting geologist, visited Park City recently.

G. L. Ellis, geologist for Snowden & McSweeney, recently made a trip to Salt Lake.

Norman Blye, Salt Lake mining engineer, is engaged in field work at Pioche, Nev.

John M. Fox has severed his connection with the Belcher Extension Consolidated Mines Co.

Henry A. Behre has been appointed assistant professor in mining in Sheffield Scientific School.

H. S. Denny has opened an office in Toronto in behalf of the Mentor Exploration & Development Co., Ltd.

S. M. Soupcoff, engineer for the American Smelting & Refining Co., has left Salt Lake on a trip to Alaska.

Horace F. Strong has been retained to direct operations at the Wigwam mine, in the Gowganda district of northern Ontario.

L. S. Cates, vice-president and general manager of the Utah Copper Co., has returned to Salt Lake from a business trip to New York.

P. S. Hanry has accepted a position with The Pure Oil Co. as production engineer for the southwestern division of the company's interests.

Lloyd C. White, metallurgical engineer associated with Burch, Hershey, & White, of San Francisco, is at Stewart, B. C., on professional business.

E. A. Hamilton, manager of mines for the United States Smelting, Refining & Mining Co., has returned to Salt Lake after a visit to Montana.

Irvine E. Stewart, of Great Falls, Mont., has been appointed chief geologist of the Montana operations of the California Petroleum Corporation

Mark L. Summers, dredge engineer for the Hammon Consolidated Gold Fields at Nome, Alaska, is now at Fairbanks, Alaska, with the Fairbanks Exploration Co.

George H. Garrey, who has been absent for ten weeks on geological examination work in Nevada, Idaho, and California, is expected back soon at his Philadelphia office.

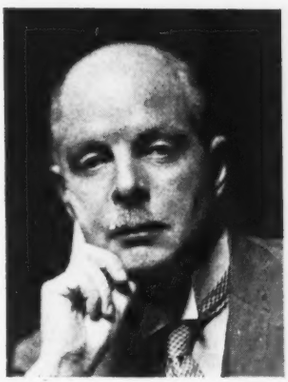
Dr. J. Mackintosh Bell, of the Huronian Belt Co., recently made an inspection of the properties in which it is interested in the Michipicoten gold areas of northern Ontario.

Raymond W. Kettner has been transferred from the Tooele plant of the International Smelting Co. to the Rico plant of that company, where he will assume the duties of chief chemist.

Arthur L. Carnahan, financial editor of the *Denver Post* and formerly connected with the copper industry in Michigan, was recently in Butte as a witness in the Carson-Anaconda case.

B. F. Armstrong is in charge of the newly established office of the Southwestern Engineering Corporation, of Los Angeles, which has been opened at Suite A, Western Building, Amarillo, Tex.

Angus B. McLeod, who has been mine superintendent of the Butte & Superior Mining Co. for many years, was elected Sheriff of Silver Bow County, Mont., at the recent election. Mr. McLeod was the only Republican elected for office in Boro County.



T. A. Rickard

T. A. Rickard delivered two lectures on the "History of Mining" at Columbia University on Nov. 16 and 18 when on his way home from London to San Francisco.

Charles W. Goodale, formerly one of the leading officers of the Anaconda Copper Mining Co., and **Dr. Waldemar Lindgren,** head of the mining course at M.I.T., were recently given a complimentary dinner at the Silver Bow Club, Butte, by former students of M.I.T.

T. J. Jones and **A. W. Stickney,** mining engineers of San Francisco, and **W. C. Madge** have taken a 20-year lease on the Silverado mines, near Orange, in Southern California. Production of zinc and lead concentrates will start as soon as repairs at the mill are completed.

P. K. Horner, consulting engineer to the Southern Rhodesian Base Metals Corporation, has been at the corporation's properties for several weeks and an extensive development program has been laid out for these areas in the Sipoia district where chrome ore, copper, lead, and zinc have been found in payable quantities.

J. Fred Johnson, of Wallace, Idaho, mining engineer, accompanied by Mrs. Johnson, has left Wallace for California and Arizona for a vacation of six weeks or more. Mr. Johnson has just completed sinking and concreting the shaft at the Morning mine for the Federal Mining & Smelting Co. to an additional depth of 400 ft.

Tokichi Korenaga, manager of the Osaka refinery of the Mitsubishi Mining Co., was in New York recently visiting the copper refineries in this district. He will visit some of the copper smelters in the Southwest and sail for Europe at the end of December to see some of the Continental metallurgical works. Mr. Korenaga says there are five copper producers in Japan: Mitsubishi, Furukawa, Kuhara, Sumitomo, and Fujita, with a combined production of about 70,000 tons annually, compared with a Japanese consumption of about 80,000 tons. Each company has its own refining plant, the multiple electrolytic system being used, but there is a common marketing association.

Obituary

As this page was sent to press, information was received of the sudden death of **Professor James Furman Kemp.** *An appreciation of Dr. Kemp's life and work will appear in our next issue.*

James Fairweather, secretary of the Rose Deep Gold Mine, died suddenly in Johannesburg on Oct. 2.

James Madden, Sr., a pioneer mining man of Basin, Mont., died on Oct. 30, at the age of sixty-eight. He was prominently connected with mines in the vicinity of Corbin, Wickes, Clancy, and Basin.

Edward J. McCool, a graduate of the Montana School of Mines with the class of 1913 and foreman of the Steward mine of the Anaconda Copper Mining Co., Butte, recently was killed in an accident on the 2,800 level of that mine.

S. C. Squier, long identified with the zinc industry of the United States, died in Greenwich, Conn., on Nov. 6. Mr. Squier was graduated from Yale sixty years ago. He had been retired from active business since the formation of the New Jersey Zinc Co. in 1897.

A. B. Greeson, long prominently identified with the mining industries of Utah, died on Nov. 4, in Salt Lake, of which city he had been a resident for thirty years. Mr. Greeson was manager and one of the owners of the *Salt Lake Mining Review.*

Edwin J. Saunders, assistant professor of geology at the University of Washington, died at his home in Seattle on Oct. 18. Dr. Saunders was a graduate of Toronto University and had been connected with educational work in the State of Washington for twenty-four years.

John McCombie, who had long been identified with the gold-mining industry of New Zealand, died recently at Remuera, at the age of seventy-six. He was born at Epsom, Auckland, and at the age of seventeen went to the West Coast alluvial gold field. After a period of prospecting, he became manager of the New Zealand Crown Mines and he was at various times interested in many other mining properties. Mr. McCombie was one of the founders of the Australian Institute of Mining Engineers and of the New Zealand Institute of Mining Engineers. He was a writer, also, both of technical articles and fiction. Latterly Mr. McCombie had been engaged principally in consulting work.

Recent Technical Publications

Reviews, Abstracts, and References

Aid for Prospectors

Handbook for Prospectors. By M. W. von Bernewitz. McGraw-Hill Book Co., New York City. Price $3.

Lamentation that prospectors are a vanishing race finds no place in this book of Mr. von Bernewitz's that the publishers have just given to the light. Instead it breathes the optimism that so often seems to be the prospector's very breath. "Where are the veins that contributed to the placers of the Klondike and its tributaries?" he asks. Untold mineral wealth must lie buried under the ice and moss of the North, he thinks, and many great veins and lodes must be hidden under the cement of the desert and the lava of the bad lands. Many an orebody has remained unfound for lack of a crosscut through a supposed vein wall. The author decidedly does not think that the prospector is disappearing. Rather, prospecting is on the increase in this country and in other countries. That he has prepared a book of over 300 pages for prospectors is evidence of his faith in the existence of the tribe. But he intends it for the student and mine official also. He has the scientific prospector in mind.

Practical advice for the trail is mingled with prospecting science presented in a practical way. Along with the mineralogy, blowpipe work, and discussion of the distribution of ores, he tells you how to pack and tie a hitch, and what to do for snake bite. The well known "cure," it might be said, he frowns upon. The aid that the prospector may get in different ways from state and federal governments and from various schools is pointed out. Facts enough about laws and regulations are given to be informative and not confusing. The important point that assessment work in the United States must be done by noon on July 1 each year is duly chronicled. These legal data will not enable one to answer all possible conundrums regarding mine assessment work, but will nevertheless be helpful. A word, too, about marketing: "To be able to sell ore is as important as to find it," the writer says.

The divining rod he warns against. He also counsels that no heed be paid the statement that assays do not give the truth as to contents of ores. Then, he tells you where to look, what minerals to look for, and how to recognize and test them. He runs the gamut of the mineralogy, paying due respect to non-metallics, finally ending with a mining glossary.

The book is practical and of much interest besides. The experience of the writer in Australia, New Zealand, Borneo, and California has been supplemented by years of service on the *Mining and Scientific Press* and, for the last five years, with the U. S. Bureau of Mines. Mr. von Bernewitz's handbook is worth placing on the five-foot shelf. A. H. HUBBELL.

Foreign Trade Opportunities

Can We Compete Abroad? A living narrative of actual experience and practice in the sale of American goods in foreign markets, without technical or economic comment. By C. C. Martin, of the National Foreign Trade Council, New York. Price 25c.

The attitude of many manufacturers toward foreign trade is that we cannot compete with foreign goods; they believe that the American standard of production must be preserved; that we cannot compete at the required low price, and we should not want to do so. In this book Mr. Martin considers these views of the American manufacturer, and gives numerous instances of actual practice and experience in the sale of American goods in foreign countries.

Mr. Martin brings out that trade competition is made effective abroad in exactly the same way as it is at home. The problem in both fields is to sell goods at a profit. Our success abroad varies directly as the planning and efficient effort put forth; this is also the rule at home. We work abroad with quotas, economic analyses, credits, forecasts, advertising, calculation of costs, and other characteristics of domestic work. We have competition of different sorts to meet abroad, as at home.

The book gives an excellent résumé of present and past conditions in our export trade, numerous examples of actual practice, and a chapter on the trend of manufacturing costs in foreign countries. In forecasting the future the author believes that there is trade enough for all commercial countries. As higher wages and better standards of living become typical for many backward countries, increased demand will emerge in these places; and many new markets will develop.

The book is interestingly written and is well worth reading by those interested in foreign trade. R. M. DAVIS.

Gears and Gear Cutting. By Philip Gates. Crosby Lockwood and Son, Stationers' Hall Court, Ludgate Hill, London, E. C. 4, England. Price, 5s.

This little English book of 135 pages is one of the series known as Lockwood's Manuals. Separate chapters are devoted to Principles, Spur Gearing, Bevel Gears, Worms and Worm Wheels, Helical Gearing, Spiral Gears, Skew Bevels, The Odontograph, and Proportion of Wheels. It is both a practical and thoretical discussion of the subject and should appeal to engineers and machinists particularly interested in gearing.

The Elements of Astronomy. By Edward Arthur Fath. McGraw-Hill Book Co., New York. Price $3.

Mining engineers and geologists have enough to worry about, in finding how this earth of ours is put together, without devoting any attention to the rest of our solar system or to the billions of other celestial objects. And yet, astronomy is one of the most interesting of sciences and one that every educated man should know something about. This book of Professor Fath's is designed as a textbook for college classes in which many of the students had had no more mathematics than a year each of algebra and geometry, so the treatment of the subject should not tax the comprehensive powers of the average engineer, and he will find much of interest within its covers. For geologists, who have not yet unanimously decided how the ore deposits under our feet came to be there, it will be comforting to know that "there is at present no generally accepted theory as to the origin of the solar system."

Transactions of the American Institute of Mining Engineers. Vol. 73. Published by the Institute at 29 West 39th St., New York. Price, $6.50, bound; $5 in paper covers.

This latest volume of the "Transactions" contains the papers and discussions presented at meetings held in New York, February, 1925; Salt Lake City, September, 1925; Syracuse, October, 1925; and New York, February, 1926. There are nine papers on nonferrous metallurgy; eight on milling and concentration; six on non-metallic minerals; twenty on metallography; and eleven on iron and steel.

Oklahoma Publications

The Oklahoma Geological Survey has recently published the bulletins listed below. The law requires that these publications be sold, and the price of each, including mailing charge, is given.

Bulletin 4. Coal in Oklahoma. Price 85c.

Bulletin 32. Geology of Southern Ouachita Mountains, Oklahoma. This bulletin deals with the stratigraphy, structure and physiography, history, geography, and economic geology of the region. Profusely illustrated with photographs, charts, and maps. Price $1.10.

Bulletin 35. Index to the Stratigraphy of Oklahoma. Price 57c.

Bulletin 37. Geology of Texas County, Oklahoma. One map, Price 57c.

Bulletin 38. Geology of Beaver County, Oklahoma. Price 57c.

Bulletin 39. Geology of Marshall County, Oklahoma. Price 57c.

Bulletin 40. Oil and Gas in Oklahoma, is being issued as separate chapters. The following have been printed, and the price of each is 30c. postpaid: 40-A. This report treats the location, geography, topography, stratigraphy, and regional and economic geology of each of the following counties in northwestern Oklahoma: Alfalfa, Woods, Harper, Major, Woodward, and Ellis. Four charts and one map. 40-B. Surface stratigraphy of northeastern Oklahoma. 40-C. Oil and Gas in Creek County, Oklahoma. 40-D. Subsurface Stratigraphy of Western Oklahoma. 40-E. Oil and Gas in Stephens County, Oklahoma. 40-F. Oil and Gas in Okmulgee County, Oklahoma. This county has more oil wells than any other county in Oklahoma. The entire subject is discussed. Illustrated with types of producing structures and a map showing fields.

For bulletins address Oklahoma Geological Survey, Norman, Okla.

New Machinery and Inventions

This new 6-yd. shovel can readily be converted into a dragline

New Stripping Shovel Announced

A new 6-yd. stripping shovel, readily and conveniently convertible into a dragline, has been just announced by the Bucyrus Company, Milwaukee, Wis. This new stripping shovel is called the 200-B and, like the 320-B, is equipped with box-girder boom and outside dipper handles. It is built for faster digging on jobs where a smaller revolving shovel has insufficient range and where an 8-yd. shovel is larger than needed. Strip mine operators who have investigated this machine believe that it will minimize the operating cost in that field.

The type of boom that the new machine uses is much lighter than a split-boom of equal strength, and it is especially adapted to withstand the severe bending strains and torsional loads. This construction is said to permit operation with less counterweight, which, in turn, is said to reduce the flywheel effect frequently encountered, so that the shovel can swing surprisingly fast.

The change from a stripping shovel to a dragline can be made by a few minor adjustments in the main machinery and a change in the boom equipment. As a dragline, the shovel is constructed to be especially adapted for digging or stripping ore, coal, and phosphates.

The 200-B may be mounted either on four-wheel trucks or caterpillars, according to what the individual specifications demand. Both types of mountings have three-point support, which reduces the load and wear on the trucks when the loaded dipper swings over the corner of the base.

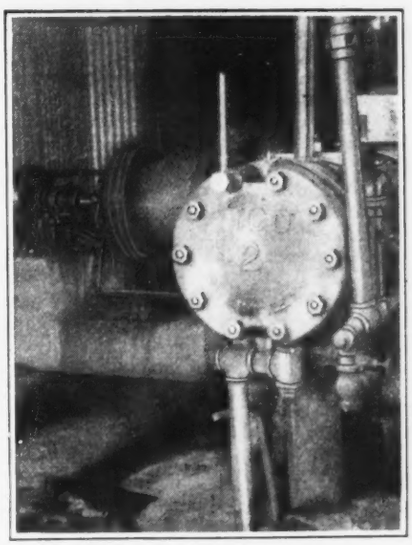
Measures Heat Transmission Through Cylinder Head

A temperature-finding device has been recently designed by the Keystone Lubricating Co., Philadelphia, Pa. This instrument assists in determining the temperature of internal combustion engines as radiated or transmitted through the external surface of the cylinder head.

It is attached to the cylinder head of the engine by the removal of one of the hexagon nuts, being secured to the protruding stud in place of the original nut. It is claimed that there can be no leakage by the substitution of this device in place of the original nut, because of its substantial construction.

This indicator is made in sizes to fit the standard studs used in building the engines now in service. Actually it is an elongated hexagon nut, closed on its outer end. Because of this inclosed side and because of the unusual length of the body, there is formed a cavity or chamber which is intended to be filled with a high-fire-test oil, when the device is affixed to an engine cylinder head. The purpose of this oil is for the absorption of the radiated heat through the stud. It is extremely sensitive to the rise and fall of heat thus radiated.

There is extended from one of the external surfaces of this nut a tube which functions as a thermometer guide and becomes an integral part of the oil chamber. This aids in supporting the thermometer in a vertical position while its bulb is immersed in the oil contained within the chamber below.



Indicates engine temperatures

Ball-Bearing Vibrating Screen Announced

A new ball-bearing vibrating screen has just been announced by Link-Belt Co., of Chicago. It is a mechanically operated device, reduced to the simplest possible mechanism—namely, one moving part which rotates in large, oversize ball bearings. The vibrator has no cams, springs, striking blocks, or levers to adjust or renew. It simply consists of a shaft, driven at suitable speed from any common source of power. This shaft, thrown out of balance by adjustable counterweights, imparts vibrations to the screen box on which it is mounted, and these in turn are transmitted to the screen cloth secured, under tension, in the box.

There are five standard sizes of these screens—namely, 2 x 5 ft., 3 x 5 ft., 4 x 5 ft., 3 x 8 ft., and 4 x 8 ft., and each can be furnished with either one or two screening surfaces, giving a wide application for materials of varying size and capacities.

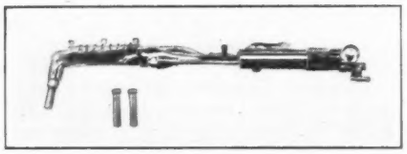
The screen cloth is placed upon the deck with its two longitudinal edges bent up. Binders are provided on the fine mesh cloths, for protection against tearing. Two flanged clamp plates engage these binders on the bent edges of the cloth; and by tightening the wing nuts on each side, the cloth can be quickly stretched to the desired tension. These side clamp plates serve the fourfold purpose of stretching the screen cloth, clamping the cloth to its neck, eliminating wear of screen-box side frames, and preventing leakage along side edges. A longitudinal vibrator strip assists the screening action by imparting raps to the cloth, minimizing wear and blinding. Binders are quickly detachable and can be re-used; and screen cloths, which are of standard width, can be obtained in rolls from the cloth manufacturers.

A feed hopper attached to the receiving end of the screen box vibrates with it, controls the feed, and uniformly spreads the material over the screening surface. For screening materials containing small particles such as brick-clay and similar materials, the vibrating feed hopper is fitted with a counterweighted swinging feed gate. This combination makes it easy to receive a non-uniform feed, and spreads the material over the width of the screen cloth at just the right speed—moreover, adding about 2 ft. to the effective length of the screen and obviating the use of mechanical distributors.

New Cutting Torch Uses Illuminating Gas

As a result of experiments and research in the utilization of a cheaper fuel that would reduce cutting costs, the Alexander Milburn Co., 1416 W. Baltimore St., Baltimore, Md., has announced a cutting torch designed to use illuminating and byproduct gases.

This torch has a superheater which heats and expands the cutting oxygen as well as the gas fuel, thus raising the temperature of the oxygen to approximately 100 deg. C. prior to



Torch using artificial or natural gas

combustion. The temperature of the gases at the torch tip is thereby increased, as is also the rate of flame propagation in the burning mixture. This reduces the oxygen consumption 25 per cent or more.

Contained within the torch is a Bunsen burner, which burns illuminating gas and heats the oxygen as it passes through a series of copper coils. It is claimed that heated and expanded oxygen, in conjunction with illuminating gas, gives better penetration into the metal, a narrow kerf and sharp, clean edges, speedy and smooth cutting with an absence of metallic slag on the underside of the cut. It does not, the manufacturers say, case-harden the surfaces cut, but leaves them in practically the same state as the original steel.

Heavy plates and slabs, risers on steel castings and structural shapes are efficiently and economically cut with this torch. When used with artificial or natural gas, because of the availability and low cost of these fuels, the expense is minimized. This torch also affords a high degree of safety. The high pressure oxygen is controlled by a thumb valve which remains fixed in either open or closed position.

Cuts Corrugated Sheet Without Distortion

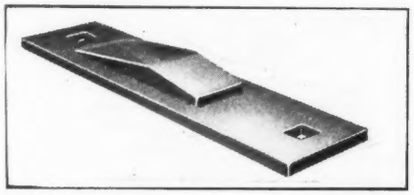
Heretofore, when corrugated metal sheets were cut on the job, the corrugations were distorted and had to be bent back again by hand. Joseph T. Ryerson & Son, Inc., 16th & Rockwell Sts., Chicago, Ill., have developed a tool that is light enough to be carried from place to place yet which will cut such sheets without distortion.

Cutting is accomplished by means of a pair of rotary double-bevel wheels knurled around the shearing edges. The upper cutter is driven by an internal ratchet which is operated by the handles, the lower one running free. The driven cutter is adjustable by means of a capscrew so as to assure a continuous, even feed on all sheets within the machine's capacity, which is up to 20 gage. After the cut is started, no effort is required to feed the shear into the work. The tool can be withdrawn from the sheet at any point by loosening the adjusting screw on the upper cutter.

Easily operated shear

Decreases Derailments at Kick Switches

For sections of mine track that are not equipped with switch stands, the West Virginia Rail Co., Huntington, W. Va., has announced a "kick" switch plate. These plates were developed to keep the latches in place after they have been pushed over and to prevent derailments on account of the switch points being left partly open. They are made with a sloping surface on the riser which prevents the switch points from being jarred open and helps to move them into the proper position, because after they are shoved over the crest the points slide into the correct position.



Kick switch plate lessens accidents

Double-Expulsion Fuse

A double-expulsion fuse is now manufactured by the Line Material Co., Milwaukee, Wis. In this device the fuse cartridge is composed of a heavy, continuous insulated tube or explosion chamber, the lower portion being provided with a larger outer tube or second explosion chamber. The fuse links have a reduced section at the top which fastens into the upper contact and is brought out of the bottom of the tube and then up through the outer tube to the lower contact. When the fuse blows, the expansion of the gases expels the arc downward, and should the arc hold, the lower explosion chamber comes into play to effectively rupture the circuit. The lower explosion chamber also serves the purpose of blowing out of the box any gases which might tend to pass upward after being expelled from the inner chamber.

This fuse is available in either wood or porcelain housings. The wood housed type is made for 6,600-volt service in capacities of 100 to 200 amp., and the porcelain-housed type is made for the same voltage but in only the 100-amp. size.

New Push-Button Stations

A number of improved push-button stations, for use with various types of industrial magnetic control. have been introduced by the General Electric Co. These cover various fields of application, each being designed to meet some special set of circumstances. A standard dust- and water-tight push-button station of particular value in cement mills, coke plants, and similar applications is embodied in a design bearing the designations BS-8-E and BS-4-AA, "Stop," and "Run—Stop" respectively. These have silver contacts inclosed in a malleable iron box with a leather diaphragm between the buttons and holes in the cover, the pressure on the leather diaphragm operating the switch.

Where it is necessary to have contacts immersed in oil to minimize the danger of explosions or to prevent corrosion of the copper contacts, the "Stop" and "Start—Stop" stations bearing the designations BS-11-CL and BS-12-DK are recommended. These are specially designed to allow easy removal of the tank for filling with oil.

Catalogs

Compressors—The Sullivan Machinery Co., Chicago, Ill., in Bulletin 83 E, describes its line of portable air compressors operated by electric motors. These are available at present in 103-ft. and 206-ft. sizes.

Roller Bearings—A copy of the new "Timken Engineering Journal" has been received from the Timken Roller Bearing Co., Canton, Ohio. This is a loose-leaf book of 110 pages containing technical information on the application of Timken bearings to automotive and industrial machinery.

Electric Welding—The Lincoln Electric Co., of Cleveland, Ohio, has issued a new bulletin describing automatic arc welding with Lincoln "Stable-Arc" automatic welders.

Air Filter — The air filter made by the American Blower Co., Detroit, Mich., is described in a 12-page bulletin issued by the company.

Crushers—Kennedy, Van Saun Manufacturing & Engineering Corporation, 50 Church St., New York, has issued a circular setting forth the advantages of the Kennedy ball-bearing gearless crusher.

Starters — The Allen-Bradley Co., manufacturers of electric controlling apparatus, of 286 Greenfield Ave., Milwaukee, Wis., has issued three bulletins. No. 600 covers alternating-current resistance starter; No. 710 the Type J-1552 Form T across-the-line starting switch; and No. 740 the Type J-3052 automatic resistance starter.

Gratings and Treads — A leaflet of the Grating Company of America, Pittsburgh, Pa., describes "Tri-Lok" gratings and treads intended for industrial plant use.

Pulverized Coal — The Grindle Fuel Equipment Co., of Harvey, Ill., has issued a bulletin describing the application of pulverized coal to the malleable foundry.

Special Machinery—The Dodge Manufacturing Corporation, of Mishiwaka, Ind., has issued a pamphlet containing a number of interesting photographs of its plant. The object of this book is to acquaint engineers and manufacturers with the company's manufacturing facilities and with its accomplishment in the special machinery field.

Market and Financial News

Granby Report Shows Rapid Progress

Third Quarter Net $595,565—Production Cost 7.890c. Per Pound Copper—Dividends Likely

FURTHER progress toward the goal of dividend paying is shown in the recently issued third-quarter report of the Granby Consolidated Mining & Smelting Co. Profit, exclusive of earnings at Allenby, before depreciation and depletion, for the third quarter was $595,565, compared with $334,473 and $33,729 for the corresponding quarters of 1925 and 1924 respectively. The following tabulation shows the comparative earnings for the nine-month periods for the last three years:

	1926	1925	1924
Gross income	$1,409,532	$1,352,752	$1,118,640
Expenses	803,399	964,098	1,042,044
Operating income	$606,133	$388,654	$76,596
Other income	58,368	9,870	28,568
Total income	$664,501	$398,524	$105,164
Bond interest	68,936	64,051	71,435
Profit before depreciation and depletion	$595,565	$334,473	$33,729

Two years ago the company was heavily in debt over and above outstanding bond issues, and the cost of production was so close to the prevailing price for copper that earnings were almost negligible. Today, under the guidance of Charles Bocking, who assumed the general managership early in 1925, the company is producing at the rate of 3,394,013 lb. of copper per month at a per-pound cost of 7.890c. The following table shows the progressive improvement during the current year at Anyox:

1926	Net Pounds Copper Produced	Average Monthly Production	Average Cost, Cents per Pound
Third quarter	10,182,038	3,394,013	7.890
Second quarter	9,519,032	3,173,011	8.495
First quarter	9,390,890	3,130,296	9.240

The average cost per pound of copper produced includes all operating and general expenses, with deductions for precious metal values and the usual smelter credits. This cost excludes credit for miscellaneous income earned and also excludes charges for bond interest and depreciation.

Granby's principal operations are centered at Anyox, B. C., where the Hidden Creek mine is the chief source of ore. The Anyox concentrator has been enlarged to give a capacity of about 2,750 tons of ore per day, and the smelting plant has been revamped to handle concentrates more economically. At the same time mine development has proved valuable additions to Hidden Creek ore reserves; and in addition the orebody in the neighboring Bonanza mine has been developed. This gives in all from 12 to 15 years' ore supply at Anyox on the basis of the current rate of production. The Copper Mountain and Outsider mines likewise contribute to the total.

The company now is earning a good profit from the operation of the Allenby properties, acquired from the defunct Canada Copper Corporation. Last fall, after reconditioning the concentrator, production was started and output has been increasing gradually.

During the third quarter, Allenby milled 174,251 tons of ore, producing 4,641,584 lb. of copper, as compared with 153,949 tons milled and 4,374,177 lb. of copper produced during the preceding quarter. These operations returned a profit of $116,335.98 for the third quarter against $86,633.11 for the second quarter, with copper carried at 14c. per pound.

Allenby production figures and profits are not included in the foregoing statistics. The net income for nine months, aggregating $1,486,997.21, is equivalent to $4.31 per share of stock outstanding. With earnings of the Allenby property included, the stock shows for the nine months' period a return of $5.06 a share after all charges but depletion and depreciation.

The company's net current assets on Sept. 30, 1926, stood at $2,921,431, an increase for the 9 months of $967,787.

Granby shares were selling at about $20 June 1, 1926; recently they have been fairly active at over $34. This reflects the excellent operating and financial showing together with the expectations that dividends are on the horizon.

Tennessee Copper Nets $643,489

The Tennessee Copper & Chemical Corporation and subsidiary companies report for six months ended June 30, 1926, net profit of $643,489 after depreciation, federal taxes, and other charges. The consolidated income account for six months ended June 30, 1926, follows: Net sales, $6,227,269; net after expenses, $872,816.

Harvard Sees Continuation of Active Business for Six Months

Irregularities from Month to Month, and in Sundry Industries, Are Anticipated

In its Weekly Letter dated Nov. 13, the Harvard Economic Service follows an analysis of the situation at the moment with a forecast for the first half of 1927. Though further expansion of business is not expected, neither is any major decline near at hand. The letter concludes with the following:

"An appraisal of the business outlook for the first half of 1927 must take into account two sets of forces: Those which govern credit conditions, and those operating directly within business itself. These two sets of forces are closely interrelated.

"When the problem is considered from the point of view of credit conditions, two important conclusions emerge. In the first place, the present reserve position is so strong that the federal reserve authorities need not yet give much attention to it when determining questions of credit policy. The resources of the system would permit considerable further expansion; and there will be no occasion for a restriction of credit unless unsound conditions develop in speculative or commodity markets. In the second place, money rates have eased promptly with the liquidation in the speculative demands for credit and the culmination of the seasonal demands for commercial accommodation.

"Thus, it appears that the October liquidation in stock prices was in no sense forced, but was rather the result of an unsettlement of speculative opinion following a sharp rise of stock prices to a level which invited reaction. Such an intermediate movement of stock prices cannot be of major significance for business; and the condition most important for the 1927 business outlook is not the October decline in stock prices, but the prompt easing in money rates. Had general economic conditions been unsound and had an old-fashioned depression been at hand, the sequel to the recent decline of stock prices would have been a tightening money market with rapidly rising interest rates. Present money conditions support the conclusion, therefore, that no business depression is probable during the first half of 1927. Indeed, so far as one can now see, a rapid tightening of money rates such as would bring about forced liquidation is improbable during the entire year that is before us.

"But while the outlook is favorable to the maintenance of something like the present volume of business, the several influences tending to moderate the rate of activity must be taken into account. In the first place, there is no clear sign that the decline in commodity prices attributable to the influence of

the restoration of the gold standard in Europe has yet come to an end; and this influence may continue to cause our business curve to drift downward for a time. Furthermore, any moderation of building activity will affect the volume of general business, since building construction has been an important stimulus to general industry during the last three years. In any case, prosperity will again be unevenly shared, as in previous years, both as between different sections of the country and different industries. Even in 1925 and 1926, years of marked prosperity for general business, particular industries have been severely depressed.

"In conclusion, then, our forecast may be briefly stated. We look forward to a continuation of active business during the next half year, despite irregularities from month to month, section to section, and industry to industry. It is hardly probable that business will attain higher levels than those of the second half of 1926; and because of the several moderating influences discussed above, including the possibility of a temporary recession in basic industry, it may average somewhat lower. Taken all in all, however, we believe that the prosperity phase of the present business cycle has not come to an end, and we expect it to continue until a marked and persistent rise of money rates, attended by declining stock prices, indicates that a major decline of business is near at hand."

Teck-Hughes Ore Reserves Tripled During Year

New Mill Being Built—Annual Report Shows Operating Profit of $751,633 on Gross Revenue of $1,510,616

The accompanying table shows the salient features of the recently issued annual report of the Teck-Hughes Gold Mines, Ltd., operating in the Kirkland district, in northern Ontario. Decreased costs and increased production and earnings are revealed. Of outstanding importance is the increase in ore reserves. Regarding this phase the report of D. L. H. Forbes, the general manager, says:

"The first stage of sinking the central shaft was completed in September, 1925, and since then the development of the 11th, 12th, and 13th levels has proceeded. This work has already met with great success. A series of large bodies of ore have been found and partly explored. Notwithstanding the uncertainty that must inevitably be connected with estimates of tonnage and value in the irregular masses of ore in this mine, it can safely be stated that the fully developed ore reserves at the end of the fiscal year were more than three times as great in value as at the beginning of the year.

"In both size and richness, some of the newly found orebodies greatly exceed any hitherto found in the mine. The south vein orebody of the No. 3 Vein System on the 13th level has an ore length of 830 ft., 519 ft. of which has an average assay value of $46.70 over an average width of 6.97 ft. Roughly parallel to this is the North Vein drift, along which an ore length of 658 ft. has already been developed, 478 ft. of which has an average assay value of $54.70 over an average width of 7.48 ft."

Construction work on the building of a new mill to supplement the existing plant, now handling 250 tons of ore per day, is progressing rapidly. It is scheduled to go into operation early in 1927.

Teck-Hughes Statistics

	1925	1926
Ore treated (tons)	48,718	79,564
Bullion production	$924,581.00	$1,461,367.00
Value per ton	18.98	18.37
Gross revenue	950,979.00	1,510,616.00
Gross revenue per ton	19.52	18.99
Total charges including depreciation	573,287.00	758,982.00
Operating costs per ton	10.88	8.80
Total charges per ton	11.77	9.54
Net operating profit	377,692.00	751,633.00
Net per ton	7.75	9.45
Cash in banks	229,958.00	121,321.00
Bonds and interest	653,972.00	1,252,332.00
Current assets	976,841.00	1,542,890.00
Current liabilities	66,759.00	115,669.00
Net surplus for year	355,083.00	718,440.00
Total surplus	1,234,794.00	2,100,784.00
Dividends	.....	474,714.00
Balance at credit Aug. 31	1,234,793.00	1,626,069.00
Capital stock outstanding	4,520,144.00	4,747,144.00

The new shaft has now reached the 14th level, where a crusher plant will be installed and further sinking will be done.

Union Minière Issues New Stock

Union Minière du Haut-Katanga, the Belgian company producing copper in Katanga, is issuing 100,000 of 6 per cent "privileged" shares of 500 francs par at 2,580 francs. At present exchange value of Belgian franc this will provide over $7,000,000 cash for construction purposes. After this sale Union Minière will have outstanding 264,000 "dividend" shares of no par, 264,000 "capital" shares of 100 francs each, 300,000 "privileged" shares of 500 francs, 20,000,000 francs of "obligations" bearing 4½ per cent interest, and 38,400,000 francs of "obligations" bearing 7 per cent interest.

Rand Gold Output

Gold output of mines on the Rand, in South Africa, in October totaled 853,000 oz., compared with 839,000 in September and 843,000 in August.

Mining Shares Bring Small Proceeds at Auction

The following mining shares have recently been sold at auction by Adrian H. Muller & Sons, New York; R. L. Day & Co., Boston; Barnes & Lofland, Philadelphia; or A. J. Wright & Co., Buffalo. Most of these stocks and bonds are not regularly quoted on an exchange. Prices are in dollars per share, except when the word "lot" is mentioned, in which case the price is for the entire lot.

No. Shares	Par Value	Company	Price per Share or Lot
7	$5	Big Ledge, lot	$1.50
100	10c.	Marcn Gold	20c.
1,700	$5	Greenwater Copper	
100	$5	Union Copper and others, lot	$30
500	$1	El Salvador Silver, lot	$1
500	..	Incaoro Mines, lot	$6
150	10c.	March Gold	18c.
50	$5	Big Ledge, lot	$7.50
200	$10	Zinc Concentrating, lot	$1
100	$10	Copper Exploration, lot	$1
150	10c.	March Gold	15c.
500	$1	Fryer Hills Mines and others, lot	$7
150	10c.	March Gold	12c.
365, 390	50c.	Victor Consclidated Mining, Oct. 20 assessment unpaid	½c.
25,000	$1	Lampazos Silver, lot	$25
100	10c.	March Gold	21c.
150	10c	March Gold	15c.
28,000	$1	Iron King Consol	4c.
200	$5	Tri-Bullion S. & D. and others, lot	$7
500	$1	Pittsburgh Gold Flat	
1,500	$1	Southern Belle Cobalt	
30	..	Timber Peak	
10,000	$1	Cirac Mining and others, lot	$15
$10,000 bonds		Carsen Hill Gold conv. 7's, coupons from March, 1925 on, lot	$1,000
2,500	$10	Canario Copper	75c.
100	10c.	Marcn Gold	17c
800	$10	Silver Bell	
500	$10	Allen M. & M. and others lot	$45
350	$1	Park Bros. and others, lot	$11
48	$5	Consol. Arizona Smelting and others, lot	$2
1,125	$5	Hudson Bay, lot	$100
100	10c.	March Gold	15c.
375	$1	Kirkland Hudson Bay, lot	$11
5,000	$1	Homestake Mines Finance, lot	$100
100	10c.	Marcn Gold	10c.
29	no	Mexican Northern M. & R.	$1.75
2,000	$5	British Guiana G. & R., lot	$10
2,500	$5	British Guiana G. & T., lot	$40
3,350	$5	British Guiana G. C., lot	$50
5,000	£1	Oroville Dredging	$1
1,000	$1	Rock Hill C. G. & S.	
9,000	$1	Nancy Hank Montana	
12,500	$1	Esmerelda	
30,000	$1	Verde Grande C.	
100	..	Antimony of Amer. and others, lot	$25
1,000	$5	Guanajuato Con., lot	$100
1,000	$10	Mexico Con. M. & S., lot	$100
6,500	$1	Ely Nevada Cop., lot	$100
8,652	£1	Santa Rosa pfd., lot	$500
17,200	$1	Notaway Mining, lot	$6
$10,000 bonds		Carmen Guanajuato Gold, 20-yr. 1st s. f. 8s, 1928, coupons from June 1911 attached, lot	$56
$900 bonds		Notaway Mining, with 9 coupons for $3.50 each, lot	$11
2,000	$1	Atlas M. & M.	
2,500	$1	Climax Zinc and others, lot	$15
100	$1	Consol Mercur, lot	$1
200	..	Asbestos Corp. Amer. pfd., lot	$10
2,000	10c.	March Gold	13c.
150	10c.	March Gold	14c.
40	$5	Big Ledge, lot	$1

Record Earnings for Texas Gulf Sulphur

Net earnings of Texas Gulf Sulphur in October were $985,000, a new high record, on 2,540,000 shares of stock outstanding. Conservative estimates place the net for the last quarter at well above $3,000,000. Since it began producing, six years ago, Texas Gulf Sulphur has earned $32,644,000, and the company has paid out in dividends $23,177,000.

The Market Report

Improved Tone in Lead—Copper Quiet

Total Metal Sales Considerably Under Those of Last Week, Though Prices Are Slightly Firmer

New York, Nov. 17, 1926—The volume of sales of lead shows fewer ups and downs from week to week than does that of copper and zinc, and during the last week business has continued good, whereas copper and zinc have sold in only about half the tonnage of the week before. Prices are very slightly higher in all three metals, perhaps reflecting improved business sentiment brought about by favorable predictions for the early months of 1927 and the agreement of the miners' delegates in England to end the coal strike. Tin continues a remarkable market, with spot prices above 70c. The pressure on silver seems to have abated, and the price has reacted upward, being above 55c. the last two days. Among the minor metals, antimony is quotably lower; the others are unchanged.

Copper at 13⅞c., Delivered

The copper market seems to be well stabilized at the current level of 13⅞c. delivered in Connecticut and 14c. at Middle Western points, for all shipments from prompt to February. These prices have ruled throughout the week on most of the business, though some small lots have been released at 13.85c. in the East and 13.95c. at higher freight-rate points. The market today is certainly no weaker than on last Thursday, for a good round lot has been sold at 13⅞c., though lower prices might have been expected in view of the meager business that has been done, less than half of last week's tonnage. Inquiry today seems somewhat improved and some attractive Middle Western business is in prospect. Though there is nothing particularly bullish in the present situation, absence of bearish factors might also be noted.

Foreign prices have been the subject of considerable comment from abroad and of much discussion among the representatives of American producers in the export association. It is rather generally felt that the spread between the foreign price of 14.275c., c.i.f. Hamburg, for example, and 13.875c., delivered Connecticut, is too great, but it is felt that the domestic price should go up rather than that the export price should come down; that only a little buying would be required to put domestic prices at 14c. or above. However, no domestic seller is asking 14c., even nominally, and it may be decided to revise the export price downward. Sales have been fairly good until the last day or two. F.a.s. copper has sold here at 14.00@14.05c.

Better Tone to Lead Market

Although there is no quotable change in the domestic markets for lead, a decidedly better tone has developed during the week ending today. Whereas a week ago sellers were quite anxious to sell at the prevailing quotations in New York, there appears to be less competition for the business, and at least one producer has raised his asking price to 8.10c. delivered in New York. Several small sales have been made at a premium of from 2½ to 5 points above the prevailing 8c. quotation, but the tonnage is not sufficient to warrant recognition in the quotations. The American Smelting & Refining Co. continues its official contract price at 8c. New York. Last Thursday and Friday lead was obtained at 7.775c. in some quarters in St. Louis, but at the same time several good-sized lots brought 7.825c. St. Louis basis, thereby offsetting the bargain metal. The leading interest in the West has done an active business at 7.80c.

There has been little change in London, but the contango has widened slightly. Around the first of November a backwardation existed in the London market, and the change is interpreted as a bullish factor. The margin by which it is more profitable to ship Mexican bullion lead abroad is still narrow, but it is effective unless a decline of some consequence should take place abroad.

A feature of the domestic market is the buying on the part of large consumers, cable and paint makers predominating. This may be interpreted as indicating that they believe the present price offers an opportunity to accumulate some modest stock. The buying is mostly for December, with less for prompt and apparently still less for January delivery. Antimonial lead is in demand at a slight premium, whereas a few weeks ago it was selling at a discount. The premium on corroding lead continues at between $2 and $3 per ton.

Daily Prices of Metals

Nov.	Copper N. Y. net refinery	Tin		Lead		Zinc
	Electrolytic	99 Per Cent	Straits	N. Y.	St. L.	St. L.
11	13.65	68.00	70.125	8.00	7.775–7.825	7.20@7.225
12	13.65	68 50	70 25	8.00	7.775–7.825	7.20@7 225
13	13.65	68.50	70 25	8 00	7 80	7 25
15	13.65	68.625	70 375	8 00	7 80	7 225@7.25
16	13.65	69 00	71.00	8.00	7.80	7 225–7.275
17	13.65	69 25	71 50	8 00	7.80	7 225–7 275
Av.	13.650	68.646	70 583	8.000	7.800	7 235

The above quotations are our appraisal of the average of the major markets based generally on sales as made and reported by producers and agencies, and represent to the best of our judgment the prevailing values of the metals for deliveries constituting the major markets, reduced to the basis of New York cash, except where St. Louis is the normal basing point, or as otherwise noted. All prices are in cents per pound. Copper is commonly sold "delivered," which means that the seller pays the freight from the refinery to the buyer's destination.

Quotations for copper are for ordinary forms of wire bars, ingot bars and cakes. For ingots an extra of 0.05c. per lb. is charged and there are other extras for other shapes. Cathodes are sold at a discount of 0.125c. per lb.

Quotations for zinc are for ordinary Prime Western brands. Quotations for lead reflect prices obtained for common lead, and do not include grades on which a premium is asked.

London

Nov.	Copper			Tin		Lead		Zinc	
	Standard		Electrolytic						
	Spot	3M		Spot	3M	Spot	3M	Spot	3M
11	57½	58⅜	65¾	309¼	298½	29 3/16	29 9/16	33½	33½
12	57⅝	58½	65¾	310¾	299¾	29½	29 15/16	34	33⅞
15	57¾	58⅝	65⅝	311	301½	29½	30	34	33⅞
16	57⅝	58½	65½	313½	302¼	29¼	29¾	33 13/16	33¾
17	57⅝	58½	65½	315½	301¾	29¼	29¾	33⅝	33⅝

The above table gives the closing quotations on the London Metal Exchange. All prices in pounds sterling per ton of 2,240 lb.

Silver, Gold, and Sterling Exchange

Nov.	Sterling Exchange "Checks"	Silver		Gold London	Nov.	Sterling Exchange "Checks"	Silver		Gold London
		New York	London				New York	London	
11	4 84¼	54⅜	25⅜	84s11½d	15	4 84⅝	54½	25¼	84s11½d
12	4 84½	54¾	25 7/16	84s11½d	16	4 84⅝	55⅜	26	84s 9¾d
13	4 84½	54⅞	25 7/16	.....	17	4 84⅝	55½	25¾	84s11½d

New York quotations are as reported by Handy & Harman and are in cents per troy ounce of bar silver, 999 fine. London silver quotations are in pence per troy ounce of sterling silver, 925 fine. Sterling quotations represent the demand market in the forenoon. Cables command one-half cent premium.

Zinc Quiet Around 7¼c.

Zinc is fractionally stronger than last week, so far as price goes, as most producers are well sold out of current production and are not disposed to press sales. The volume of business, however, has been much less than last week. On Friday, a good tonnage was sold to favorably situated consumers as low as 7.20c., St. Louis, for both November and December shipment, but most buyers have had to pay more, particularly in the last two or three days. Prompt shipment has recently commanded about 7.25@7.275c., and December 7.225@7.25. Little interest is yet taken in January. High-grade is unchanged at 9@9.25c., delivered in the East.

Better Prices for Tin

Spot Straits tin continues scarce, with prices about half a cent above the figures quoted in the table on page 837, which are for prompt delivery. Consumers were in the market on Monday and have bought some tin today, but the market generally has been dull rather than active. A strong advance in London is the consequence largely of active buying by the principal operator. Tin of 99 per cent grade is closely held, but small sales have been made each day during the week.

Silver Improves—Now 55½c.

Silver advanced steadily during the last week on the strength of purchases by the Indian bazaars. These buying orders have been placed both in London and New York, and are for the earliest shipment possible. As a result, the demand for near-by delivery has exceeded available supplies, thereby forcing prices up sharply. China has operated in a small way on both sides of the market, but the position of buyers there continues a relatively unimportant factor. The market closes quiet and steady, with the future tendency depending on India.

Mexican Dollars (Old Mexican pesos) Nov. 11th, 41⅜c.; 12th, 41⅜c.; 13th and 15th, 41⅞c.; 16th, 42¼c.; 17th, 42¼c.

Exchanges Slightly Higher

Closing cable quotations on Tuesday, Nov. 16, were as follows: francs, 3,3625c.; lire, 4.195c.; marks, 23.745c. Canadian dollars, ⅝ per cent premium.

Other Metals

Quotations cover large wholesale lots unless otherwise specified. London prices are according to latest mail advices.

Aluminum—Both 98 and 99 per cent grades quoted at 27c. per lb. London, £107 per long ton for domestic metal.

Antimony—Per lb., duty paid, New York: Chinese brands, spot 13c.; December 13c. Cookson's "C" grade, 17½c. Needle and oxide nominally unchanged from quotations in the Nov. 6 issue.

Bismuth—Per lb., New York, in ton lots, $2.70@$2.75. London, 10s.

Cadmium—Per lb., New York, 60c. London, 1s. 10½d.@1s. 11d. for American metal; 1s. 9d. for Australian metal.

Iridium—Per oz., $120@$125 for 98 @99 per cent sponge and powder. Firm. London, £32½ in iridio-platinum; £18@ £22 for sponge and powder. Nominal.

Nickel — Per lb., ingot, 35c.; shot, 36c.; electrolytic, 39c. (99.75 per cent grade). London, £170@£175 per long ton according to quantity.

Osmium—Per oz., $55@$60. London, £16@£19.

Palladium—Per oz., $66@$70. Pure metal as a constituent of crude platinum, $55@$60 per oz. London £11@ £13, nominal.

Platinum — Official price on refined metal, $112 per oz. Open market cash sales of large lots, $107. Pure metal as a constituent of crude platinum, $105. Market dull.

London, £23 per oz. for refined and £20½ for crude. Dull.

Quicksilver — Per 75-lb. flask, $98.50 @$99.50. San Francisco wires $99, steady. London, £16½.

Ruthenium—Per oz., nominally $45@ $50. London, £7½@£11.

The prices of **Cobalt, Germanium Oxide, Lithium, Magnesium, Molybdenum, Monel Metal, Radium, Rhodium, Selenium, Tantalum, Tellurium, Thallium, Tungsten,** and **Zirconium** are unchanged from the issue of Nov. 6.

Metallic Ores

Manganese Ore—Per long ton unit of Mn, c.i.f. North Atlantic ports, minimum 47 per cent Mn, 32@34c. Caucasian (washed), 53@55 per cent, 38@ 40c. The market is firmer on account of smaller imports.

[1]Chemical grades, powdered, coarse or fine, 82@87 per cent MnO_2, Brazilian and Cuban, $70@$80 per ton in carloads.

Tungsten Ore — Per unit of WO_3, N. Y.: Wolframite, $10.50@$10.75; Western scheelite, $11@$11.25. Dull.

Chrome, Iron, Molybdenum, Tantalum, Uranium, and **Vanadium Ores** are unchanged from quotations in the Nov. 6 issue.

Zinc Blende and Lead Ore Prices Unchanged

Joplin, Mo., Nov. 13, 1926

Blende

High		$51.90
Premium blende, basis 60 per cent zinc	$48.00@	49.00
Prime Western, basis 60 per cent zinc		47.00
Fines and slimes, 60 per cent zinc	46.00@	43.00
Average settling price, all zinc		47.64

Galena

High	$105.00
Basis 80 per cent lead	100.00
Average settling price, all lead	103.59

Shipments for the week: Blende, 17,627; calamine, 55; lead, 1,863 tons. Value, all ores the week, $1,036,290.

Sellers, until this week, have been disposing of their current production, but the price offered today brought onto the market less than 15,000 tons. Deducting the tonnage sold, the reserve stock is approximately 15,000 tons, or less than one week's output.

Lead buyers all returned to the $100 basis price this week, with rumors of bonus offers for coarse concentrate unmixed with slimes.

[1]Price furnished by Foote Mineral Co., Philadelphia.

Platteville, Nov. 13, 1926

Zinc Blende	Per Ton
Blende, basis 60 per cent zinc	$49.75
Lead Ore	
Lead, basis 80 per cent lead	$101.00

Shipments for the week: Blende, 1,418 tons; lead, 40 tons. Shipments for the year: Blende, 49,253; lead, 1,726 tons. Shipments for the week to separating plants, 1,991 tons blende.

Non-Metallic Minerals

Amblygonite, Asbestos, Barytes, Bauxite, Borax, Celestite, Chalk, China Clay, Diatomite, Emery, Feldspar, Fuller's Earth, Fluorspar, Garnet, Gilsonite, Graphite, Greensand, Gypsum, Ilmenite, Iron Oxide, Lepidolite, Limestone, Magnesite, Mica, Monazite, Ocher, Phosphate, Potash, Pumice, Pyrites, Quartz Rock Crystals, Silica, Spodumene, Sulphur, Talc, Tripoli, and **Zircon** are unchanged from prices in the Nov. 6 issue.

Mineral Products

Arsenious Oxide (White Arsenic)—3½c. per lb. Very quiet market. London, £15¾@£16½ per long ton.

Calcium Molybdate, Copper Sulphate, Sodium Nitrate, Sodium Sulphate (Salt Cake), and **Zinc Oxide** are unchanged from prices in the Nov. 6 issue.

Ferro-Alloys

Ferromanganese — Domestic, 78@82 per cent, $100 per long ton, furnace, for delivery during first half of 1927. Market active. Sellers bullish. Spiegeleisen, 19@21 per cent, $34@$35 f.o.b. furnace; 16@19 per cent, $32@$34. Advance due to higher coke prices.

Ferrocerium, Ferrochrome, Ferrophosphorus, Ferrosilicon, Ferrotitanium, Ferrotungsten, Ferro-uranium and **Ferrovanadium** are unchanged from prices in the Nov. 6 issue.

Metal Products

Rolled Copper, Lead Sheets, Nickel Silver, Yellow Metal and **Zinc Sheets** unchanged from issue of Nov. 13.

Refractories

Fireclay Brick, Chrome Brick, Magnesite Brick, Silica Brick and **Zirkite** are unchanged from quotations in the Nov. 6 issue.

Steel and Pig Iron Continue Steady—Coke Weak

Pittsburgh, Nov. 16, 1926

Steel-ingot production was at about 2 per cent higher rate in October than in August and September, those months running substantially together.

Pig Iron—The Valley market has not substantiated the recent dollar advance in asking prices, except that bessemer is up 50c., at $20. Basic has gone at $18.50, and foundry iron remains quotable at $19@$20. Inquiry continues light.

Connellsville Coke—Coke prices have been weakening on account of recent declines in the coal market, and the British coal strike settlement will probably have a further depressing effect. At the moment spot furnace coke is $4.75@$5 and spot foundry $6@$6.50, with demand light.

Freight Rates on Metals, Ores, and Concentrates

Carload Lots

Copper Bullion and Refined Copper

From	To	Rate per Ton of 2,000 Lb. All Rail	Via Gulf
El Paso, Tex.	Baltimore, Md.	$11.40	$10.00(a)
Garfield, Utah	Perth Amboy	12.50	.....
Garfield, Utah	San Francisco	5.85	.....
Hayden, Ariz.	Perth Amboy	14.50	12.50
Miami, Ariz.	Perth Amboy	14.50	12.50
Anaconda, Mont.	Perth Amboy	12.50	.....
Butte, Mont.	Perth Amboy	12.50	.....
Humboldt, Ariz.	Chrome, N. J.	14.50	12.50
Douglas, Ariz.	Perth Amboy	14.50	12.50
Globe, Ariz.	Perth Amboy	14.50	12.50
Clifton, Ariz.	Perth Amboy	14.50	12.50
Clarkdale, Ariz.	Chrome, N. J.	14.50	12.50
(a) Via Southern S.S. Co. or Morgan Line		....	$9.40
Copperhill, Tenn.	Laurel Hill, N. Y.	$10.80	.....
Tooele, Utah	Chrome, N. J.	12.50	.....
McGill, Nev.	Baltimore, Md.	12.90	.....
Houghton, Mich.	New York	9.60	.....
Hancock, Mich.	New York	9.60	.....
Hubbell, Mich.	New York	9.60	.....
Dollar Bay, Mich.	New York	9.60	.....
Via Canal			
Anaconda, Mont.	Tacoma, Wash.	7.09	.....
Ajo, Ariz.	New York	14.50	$12.50

Marine Freight Rates (a)

New York to
- Hamburg... $4.50 per gross ton copper and lead
- Liverpool... 6.32½ per gross ton copper and lead
- Antwerp... 4.00 per gross ton copper and lead
- Havre... 4.75 per gross ton lead
- 5.00 per gross ton copper

Gulf ports to
- Hamburg... $4.50 per gross ton copper and lead
- Liverpool... 5.50 per gross ton copper and lead
- Antwerp... 4.00 per gross ton copper and lead
- Havre... 5.00 per gross ton copper

Pacific coast ports to
- Hongkong... $5.00 per short ton copper and lead
- Kobe... 5.00 per short ton copper and lead

(a) Rates now subject to readjustment. Definite rates will be published when fixed.

Lead Bullion (Pig Lead Where Shown)

From	Rates per Ton of 2,000 Lb. To New York		To St. Louis
East St. Louis, Ill.	$7.00		.....
Pueblo, Colo.	12.50		$9.00
Leadville, Colo.	12.50		9.00
East Helena, Mont	12.50		9.50
El Paso, Tex.	10.00	Via Gulf	
	12.00	All Rail	7.00
Omaha, Neb.	9.60		3.65
Murray, Utah	12.50		9.00
Midvale, Utah	12.50		9.00
Tooele, Utah	12.50		9.00
East Chicago, Ill.	6.40		(a) 1.60
Kellogg, Idaho	13.50		9.50
Carnegie, Pa.	3.80		(a) 5.00
Selby, Calif.	(b) 6.00		.....
Herculaneum, Mo.	(a) 8.80		(a) 1.80
Federal, Ill.	7.00		(a) 1.80
Collinsville, Ill.	7.00		(a) .75½
Granby, Mo.	(a) 10.50		(a) 3.50
Joplin, Mo.	(a) 10.50		(a) 3.50

(a) Pig lead only.
(b) Conference rate, via canal.

Slab Zinc

From	Rates per Net Ton to E. St. Louis	New York
Donora, Pa.	(a) $4.60	$3.80
Langeloth, Pa.	(a) 4.60	3.80
Palmerton, Pa.	7.10	3.00
Hillsboro, Ill.	1.40	7.00
Danville, Ill.	1.60	6.40
La Salle, Ill.	1.60	6.70
Springfield, Ill.	3.00	7.00
Cleveland, Ohio	5.80	5.00
Moundsville, W. Va.	4.40	3.80
Van Buren, Ark.	3.80	10.80
Fort Smith, Ark.	3.80	10.80
Bartlesville, Okla.	3.50	10.50
Blackwell, Okla.	3.80	10.80
Henryetta, Okla.	3.80	10.80
Sand Springs, Okla.	3.80	10.80
Cherryvale, Kan.	3.50	10.50
Black Eagle, Mont.	9.40	12.50
Park City, Utah	9.00	12.50
Amarillo, Tex.	5.80	12.80

(a) To St. Louis, Mo.

Zinc Ores and Concentrates

To	From	Rate per Net Ton
Bartlesville, Okla.	Altoona, Kan.	$2.10
	Pittsburg, Kan.	1.09
	Galena, Kan.	1.30
	Joplin, Mo.	1.40
	Iola, Kan.	1.09
	Baxter, Kan.	1.50
	Miami, Okla.	1.40
	Quapaw, Okla.	1.40
	Kansas City, Mo.	1.60
Sand Springs, Okla.	Miami, Okla.	2.20
	Quapaw, Okla.	2.20
	Galena, Kan.	1.50
	Joplin, Mo.	1.50
	Iola, Kan.	2.40
Dewar, Okla.	Cave Springs, Mo.	2.00
Kusa, Okla.	Cent City Spur, Mo.	2.00
Henryetta, Okla.	Chitwood, Mo.	2.00
	Galena, Kan.	1.50
La Harpe, Kan.	Mound City, Kan.	.50
	Oswego, Kan.	.50
	Parsons, Kan.	.50
Coffeyville, Kan.	Galena, Kan.	1.10
	Joplin, Mo.	1.22
Bartlesville, Okla. (a)	Baxter, Kan.	1.80
	Miami, Okla.	1.80
	Quapaw, Okla.	1.80

(a) Lead ore and concentrates.

Rates on Ores and Concentrates

From	To	Value of Product $5	$10	$15	$20	$25	$30	$35	$40	$50	$60	$70	$75	$80	$90	$100
		Rate														
Butte, Mont.	Anaconda, Mont.	.22	.22	.22	.22	.22	.22	.22	.22	.22	.22	.22	22	.22	.22	.22
Butte, Mont.	Black Eagle, Mont. (a)	....	....	....	....	....	....	....	1.01	....	....	....	....	....	....	1.01
Great Falls, Mont.	Helena, Mont (b)	....	....	1.50	....	1.69	....	1.91	....	2.36	....	....	....	....	....	2.48
Butte, Mont.	East Helena, Mont	....	....	1.17	....	1.46	....	1.69	....	2.03	....	....	....	....	....	2.14
Paxton, Calif.	Salt Lake Smelters, Utah	....	....	....	....	....	....	....	....	5.50	6.00	6.70	....	7.40	8.10	8.80
Johannesburg, Calif.	Selby, Calif.	....	....	....	2.90	....	3.50	....	4.10	4.70	5.30	5.90	....	6.50	6.80	7.10
Johannesburg, Calif.	Humboldt, Ariz.	....	....	....	3.40	....	4.10	....	4.80	5.50	6.20	6.90	....	7.60	8.00	8.30
Pioche, Nev.	Humboldt, Ariz.	....	....	7.74	....	8.55	....	9.36	....	9.99	....	....	11.25	....	....	12.42
Creede, Colo.	Durango, Colo.	....	....	3.25	3.50	3.75	4.00	....	4.25	4.75	5.25	5.75	6.05	....	....	7.10
Ouray, Colo.	Durango, Colo.	....	....	4.30	4.80	....	5.05	....	5.50	5.90	....	6.30	....	....	....	7.70
Telluride, Colo.	Durango, Colo	....	....	....	4.00	....	4.30	....	4.60	5.10	5.60	6.10	....	6.50	7.00	7.50
Silverton, Colo.	Durango, Colo	....	....	1.40	1.40	....	....	2.20	....	....	....	....	....	2.30	2.55	2.80
Tyrone, N. M.	Douglas, Ariz.	....	....	1.60	1.90	....	2.20	....	2.50	2.80	....	..	3.10	....	....	3.40
Tyrone, N. M.	El Paso, Tex.	....	....	1.60	1.90	....	2.20	....	2.50	2.80	....	..	3.10	....	....	3.40
Lordsburg, N. M.	Douglas, Ariz.	....	1.00	1.30	1.70	....	2.00	....	2.30	2.60	....	....	3.20	....	....	3.80
Lordsburg, N. M.	El Paso, Tex.	....	1.00	1.30	1.80	....	2.10	....	2.40	2.70	....	....	3.30	....	....	3.90
Tombstone, Ariz.	Douglas, Ariz.	....	....	.60	1.30	.90	1.60	....	1.90	2.20	....	....	2.80	....	....	3.40
Tombstone, Ariz.	El Paso, Tex.	....	1.60	1.90	....	2.50	....	....	3.50	3.80	....	....	4.40	....	....	5.00
Ray Junction, Ariz.	Hayden, Ariz.	....	.10	....	.40	....	.50	....	.80	.90	....	....	1.00	....	....	1.10
Sandon, B. C. Alamo Concentrator, B. C.	Tadanac, B. C.	1.50	1.60	1.70	1.90	2.00	2.50	....	2.60	2.90	3.40	3.50	....	3.70	3.80	3.90
Rossland, B. C.	Tadanac, B. C.	.90	.90	1.00	1.00	1.10	1.50	....	1.60	1.60	1.60	1.70	....	1.70	1.70	1.70
Rossland, B. C.	Tadanac, B. C. (d)	.30	.30	.30	.30	.50	.70	....	.80	.80	....	....	....	....	....	....
Republic, Wash.	Tadanac, B. C.	....	2.11	2.56	2.66	2.86	3.84	....	3.84	3.84	4.69	4.89	....	5.19	5.39	5.59

(a) Minimum tonnage of 200 tons per day. (b) In open cars, minimum 80,000 lb. (c) Plus $2.70 per car switching.
(d) Applicable on ore only when shipped in trainload lots of not less than 10 cars and exclusive of switching charges at Rossland.

From	To	Value of Ores and Concentrates $10	$15	$20	$25	$30	$35	$40	$50	$60	$70	$75	$80	$90	$100
		Rate													
Burke, Idaho (a) (d)	Bradley, Idaho	....	....	....	....	....	....	....	....	.68	....	.....	....	....	1.02
Burke and Wallace, Idaho	East Helena, Mont.	....	....	....	....	3.00	....	3.25	3.50	3.75	4.00	.....	4.25	4.50	4.75
Sagel, Idaho	East Helena, Mont.	....	....	....	3.38	....	3.83	....	4.16	....	....	.....	....	....	4.84
Arizona Tunnel, Idaho	Bradley, Idaho	....	....	....	....	....	....	....	....	.35	....	.....	....	.....	.50
Bayview, Idaho	Bradley, Idaho	....	....	....	....	....	....	....	3.75	....	....	4.37½	....	.....	5.12
Park City, Utah	Salt Lake Smelters	1.00(c)	1.10	1.25	....	1.50	....	1.75	....	2.00	....	.....	2.25	.....	2.50
Eureka, Utah	Salt Lake Smelters	1.00	....	1.25	....	1.50	....	1.75	2.00	2.25	2.50	.....	2.75	3.00	3.25
Tintic, Utah	Salt Lake Smelters	1.00	....	1.25	....	1.50	....	1.75	2.00	2.25	2.50	.....	2.75	3.00	3.25
St. Johns, Utah	Salt Lake Smelters	1.00	....	1.25	....	1.50	....	1.75	2.00	2.25	2.50	.....	2.75	3.00	3.25
Ophir, Utah	Salt Lake Smelters	1.00	....	1.25	....	1.50	....	1.75	2.00	2.25	2.50	.....	2.75	3.00	3.25
Bingham, Utah	Garfield, Utah	....	.40	....	.75	....	....	....	.95	....	....	1.10	....	....	1.25
Cherry Creek, Nev.	Garfield, Utah (c)	....	....	4.60	....	5.10	....	5.60	6.10	6.60	7.10	.....	7.60	8.10	8.60
Cherry Creek, Nev.	Garfield, Utah (b)	....	....	3.20	....	3.90	....	4.60	5.30	6.00	6.70	.....	7.40	....	....
Goldfield, Nev.	Salt Lake Smelters	....	4.15	5.10	....	5.80	....	6.50	7.20	7.90	8.60	.....	9.30	10.00	10.70
Battle Mountain (a)	Salt Lake Smelters	....	....	3.20	....	3.80	....	4.40	5.00	5.60	6.20	.....	6.80	7.40	8.00
Palisade, Nev. (a)	Salt Lake Smelters	2.20	2.90	3.20	....	3.80	....	4.30	4.80	5.30	5.80	.....	6.30	6.80	7.30
Mina, Nev. (a)	Salt Lake Smelters	....	....	3.60	....	4.30	....	5.00	5.70	6.40	7.10	.....	7.80	8.50	9.20
Lovelock, Nev. (a)	Salt Lake Smelters	....	....	3.20	....	3.90	....	4.60	5.30	6.00	6.70	.....	7.40	8.10	8.80
Goleonda, Nev. (a)	Salt Lake Smelters	....	....	3.20	....	3.90	....	4.60	5.30	6.00	6.70	.....	7.40	8.10	8.80
Hazen, Nev. (a)	Salt Lake Smelters	....	....	3.20	....	3.90	....	4.60	5.30	6.00	6.70	.....	7.40	8.10	8.80
Tonopah, Nev.	Salt Lake Smelters	....	4.15	5.10	....	5.80	....	6.50	7.20	7.90	8.60	.....	9.30	10.00	10.00
Rogerson, Idaho	Salt Lake Smelters	3.00	....	3.50	....	4.00	....	4.50	5.00	5.50	6.00	.....	6.50	7.00	7.07
Georgetown, Colo.	Leadville, Colo.	....	....	3.50	....	3.75	....	4.00	5.00	5.00	5.80	.....	6.50	5.80	5.85

(a) Minimum weight, marked capacity of car used, but not less than 80,000 lb. (b) Minimum weight, 80,000 lb. (c) Minimum weight, 40,000 lb.
(d) Crude ore for concentration, 30c. per ton.
(e) For $9 value rate is 95c.; $8 values, 90c.; $7 value, 85c.; $6 value, 80c.
(d) Indicates a change of tariff since June 19.

Mining Stocks—Week Ended November 13, 1926

Stock	Exch.	High	Low	Last		Last Div.
COPPER						
Anaconda	New York	49⅛	47¾	49	Oc.16, No.22 Q	0.75
Arcadian Consol.	Boston	*98	*85	*85		
Ariz. Com'l	Boston	11¼	10⅛	10⅛	Jy. 16, Jy. 30	0.50
Calaveras	N. Y. Curb	1⅛	1⅛	1⅛		
Calumet & Arizona	New York	71¼	67	70	Se. 4, Se. 20 Q	1.50
Calumet & Hecla	Boston	17⅛	16⅛	16⅛	Au.31, Se.15	0.50
Cerro de Pasco	New York	64⅜	63⅛	64⅛	Jy. 15, Au.2, Q	1.00
Chile Copper	New York	33	32⅛	32⅛	De.1, De.27, Q	0.62½
Chino	New York	....	....	25½		
Con. Coppermines	N. Y. Curb	2⅞	2⅜	2⅞		
Copper Range	Boston	15⅛	14⅜	15	May, 1925	1.00
Crystal Copper	Boston Curb	*34	*30	*32		
East Butte	Boston	3¼	3	3¼	Dec., 1919	0.50
First National	Boston Curb	*7	*6	*6	Feb., 1919	0.15
Franklin	Boston	*30	*30	*30		
Granby Consol.	New York	35⅛	31⅛	34⅛	May, 1919	1.25
Greene-Cananea	New York	30⅜	23	27⅞	Nov., 1920	0.50
Hancock	Boston			*50		
Howe Sound	New York	42⅛	40⅛	42⅛	Oc.1, Oc.15 Q	1.00
Inspiration Consl.	New York	28⅝	26	27⅝	Se.16, Oc.4, Q	0.50
Iron Cap	Boston Curb	3⅛	3	3		
Isle Royale	Boston	12⅞	11⅛	12⅛	Jn. 1, Jn. 15	0.50
Jerome Verde Dev.	N. Y. Curb	48	48	48		
Kennecott	New York	63⅝	62⅜	62⅞	Sept. 3, Oct. 1 Q	1.00
Lake Copper	Boston	1	*75	1	June, 1925	0.50
Magma Copper	New York	38⅛	36⅛	37⅛	Oc.1, Oc.15, Q	0.75
Mason Valley	N. Y. Curb	2	1⅞	1⅞		
Mass Consolidated	Boston	....	....	*35	Nov., 1917	1.00
Miami Copper	New York	17	16⅝	16⅞	No.1, No. 15 Q	0.37½
Mohawk	Boston	44⅛	42	43⅛	Oc.30, De 1 Q	2.00
Mother Lode Coa.	New York	5⅛	5	5⅛	Jn. 15, Jn. 30	0.37½
Nevada Consol.	New York	16⅛	15⅜	15⅞	Oc.14, Nov.16	0.25
New Cornelia	Boston	23⅜	22⅞	23	No.5, No.22 Q	0.50
Noranda	N. Y. Curb	19	18⅞	18⅞		
North Butte	Boston	3	2⅞	3	Oct., 1918	0.25
Ohio Copper	N. Y. Curb	*38	*37	*37	Se. 1, Se. 15	0.05
Old Dominion	Boston	16⅞	16	16⅛	Dec., 1918	1.00
Phelps Dodge	Open Mar.	†137	†134		Se.25, Oc.2 Q	1.50
Quincy	Boston	19⅛	18⅛	18⅛	Mar., 1920	1.00
Ray Consolidated	New York	16⅞	16⅛	16⅛	Ap.20, Ap.30	0.25
Ray Hercules	N. Y. Curb			11⅞		
St. Mary's Min. Ld.	Boston	28⅛	27	27	Ap.17, My.18	2.00
Seneca Copper	New York	4⅛	4	4⅛		
Shannon	Boston	*50	*30	*30	Nov., 1917	0.25
Shattuck-Denn	Boston Curb	7⅛	5⅞	7		
Superior & Boston	Boston	*40	*25	*40		
Tenn. C. & C.	New York	11⅞	11⅛	11⅛	No.30, De.15, Q	0.25
United Verde Ex.	N. Y. Curb	25	24	25	Oc.16, No. 1, Q	0.75
Utah Copper	New York	116	110	116	Se.3, Se.17 Q	1.75
Utah Metal & T.	Boston	1⅜	1⅛	1⅛	Dec., 1917	0.30
Victoria	Boston	*65	*60	*65		
Walker Mining	Salt Lake	*71	*70	*70		
NICKEL-COPPER						
Internat. Nickel	New York	38⅜	35⅞	38	Se.7, Se.30, Q	0.50
Internat. Nickel, pfd.	New York	...	...	103	Oc.14, No.1,	1.50
LEAD						
Gladstone Mtn.	Spokane	*29	*28½	*29	Oct., 1926	0.01
National Lead	New York	153	151⅞	153	Sept., 1926 Q	2.00
National Lead pfd.	New York	116½	116⅛	116½	No.19, De.15 Q	1.75
St. Joseph Lead	New York	40⅛	39⅛	40¼	Sept., 1926 QX	0.75
ZINC						
Am. Z. L. & S.	New York	9	7⅞	8⅜	May., 1917	1.00
Am. Z. L. & S, pfd.	New York	46	39½	45⅛	Nov., 1920	1.50
Butte C. & Z	New York	5⅛	4⅞	5⅛	De.10, De.24	0.50
Butte & Superior	New York	14⅛	13	13⅛	Se.15, Se.30 Q	0.50
Callahan Zn-Ld	New York	1⅜	1⅛	1⅛	Dec., 1920	0.50
Eagle-Picher	Cincinnati	29¾	29⅛	29½	Au.14, Se.1 Q	0.40
Eagle-Picher, pfd.	Cincinnati	....	....	100	Se. 30, Oc. 5 Q	1.50
New Jersey Zn.	N. Y. Curb	....	....	191	No.20, De.10 X	2.00
United Zinc	N. Y. Curb	....	....	*70		
Yellow Pine	Los Angeles	*15	*15	*15	Dec. 1925 Q	0.04
GOLD						
Alaska Juneau	New York	1⅛	1⅛	1⅛		
Argonaut	Toronto	*61	*56¾	*57		
Barry-Hollinger	Toronto	1	*91⅞	*93		
Carson Hill	Boston	*29	*25	*25		
Consol. W. Dome L.	Toronto	*23½	*21⅛	*22⅛		
Cresson Consol. G.	N. Y. Curb	2⅛	2⅛	2⅛	Oct, 1926	0.10
Crown Reserve	Toronto	*12	*10⅞	*11⅛	Jan., 1917	0.05
Dome Mines	New York	10	9⅞	10	Se.20, Oc.30, Q	0.50
Golden Center	N. Y. Curb	2	1⅞	2		
Golden Cycle	Colo Spring	....	....	2	No.30, De.10 Q	0.04
Hollinger Consol.	Toronto	18.65	18.50	18.60	No.16, De.2 F	0.10
Homestake Mining	New York	61	61	61	No.20, No.26 M	0.50
Kirkland Lake	Toronto	*79	*62⅞	*77⅞		
Lake Shore	Toronto	14.75	14.10	14.60	No.1, De.15 Q	0.25
McIntyre-Porcupine	New York	24	23⅜	23⅞	No.1, De.1 Q	0.25
Newray	Toronto	*39	*38	*39		
Night Hawk Pen.	Toronto	*4	*3⅞	*3⅞		
Portland	N. Y. Curb	....	....	*43		
Rand Mines	New York	....	....	41⅜	Au.23–30	Am.Sh. 1.52
Teck-Hughes	Toronto	4.96	4.89	4.94	Jy. 15, Au. 2	0.05
Tom Reed	Los Angeles	2⅛	2⅛	2⅛	March, 1926	0.02
Tough-Oakes	Toronto	*61	*55⅞	*58⅜		
United Eastern	N. Y. Curb	*45	*43	*43	July, 1924	0.05
Vipond Cons.	Toronto	1.65	1.58	1.63		
Wright-Hargreaves	Toronto	8.55	8.40	8.50	Se.15, Oc.1 QX	0.07½
Yukon-Alaska Trust	N. Y. Curb	....	....	20		
GOLD AND SILVER						
Carnegie Metals	Boston	....	....	12		
Con. Cortez	N. Y. Curb	*5	*4	*4		
Con. Virginia	San Francisco	*8⅛	*7⅛	*7⅛		
Continental Mines	N. Y. Curb	....	....	*48		
Dolores Esperanza	N. Y. Curb	....	....	*45	July, 1923	0.05
Premier Gold	N. Y. Curb	2	1 15/16	1 15/16	Se.15, Oc.4 Q	0.08
Tonopah Belmont	N. Y. Curb	....	....	2⅞	Se.15, Oc.1	0.05
Tonopah Extension	N. Y. Curb	....	....	*34	Apr. 1925	0.05
Tonopah Mining	N. Y. Curb	3¾	3½	3½	Se.30, Oc.27 SA	0.07½
Unity Gold	N. Y. Curb	....	....	*30		
West End Consol.	N. Y. Curb	*3	*3	*3	Mar., 1923	0.05
Yukon Gold	N. Y. Curb	*49	*49	*49	June, 1918	0.02

Stock	Exch.	High	Low	Last		Last Div.
SILVER						
Alvarado	N. Y. Curb	....	....	1	Oct., 1920	0.50
Beaver Consol.	Toronto	*60	*57½	*59½	May. 1920	0.03
Castle-Trethewey	Toronto	1.15	1.03	1.15		
Conagas	Toronto	4.40	4.40	4.40	May, 1924	0.12½
Keeley	Toronto	1.60	1.55	1.59	Se. 1, Se.15 SA	0.12
Kerr Lake	N. Y. Curb	....	....	*71	Oc.1, Oc.15 SA	0.12½
La Rose	Toronto	*6½	*5	*5	Apr., 1922	0.10½
Lorrain Trout Lake	Toronto	*50	*50	*50	Jy. 2, Jy. 15	0.05
McKinley-Dar.-Sav.	Toronto	*13¾	*11	*13¾	Oct., 1920	0.03
Mining Corp. Can.	Toronto	2.75	2.65	2.73	Jy.1, Jy.15 SA	0.12½
Nipissing	N. Y. Curb	5⅜	5¼	5⅜	Se.30, Oc.20 Q	0.15
Temiskaming	Toronto	....	....	*8	Jan., 1920	0.40
SILVER-LEAD						
Ahumada	New York	6¾	5¾	5⅞	Se.28, Oc.1, QX	0.25
Alta Merger	Salt Lake	†*4	†*2			
Bingham Mines	Boston	35½	34	34	Se.20, Se.30 Q	1.00
Cardiff M. & M.	Salt Lake	*26	*26	*26	Nov., 1924	0.10
Chief Consol.	Salt Lake			2.60	De.15, Ja.2 Q	0.75
Consti'n Mng. & Mill'g	Spokane	*57	*52	*57		
Emma Silver	Salt Lake	†1	†*75			
Erupcion	Boston Curb	1⅜	1⅛	1⅛	Se.25, Oc.1, QX	0.10
Federal M. & S.	New York	90	90	90		
Federal M. & S., pfd.	New York	75⅜	74⅛	74⅜	Au.25, Se.15 Q	1.75
Hawthorne Mines	N. Y. Curb	*11	*8	*11		
Hecla Mining	N. Y. Curb	16⅞	16⅛	16⅛	No.15, De.15 Q	0.50
Highland-Surprise	Spokane	*24¼	*22⅛	*23⅝		
Iron King Mining	Salt Lake	*15	*13	*15		
Keystone Mining	Salt Lake			*26	Au.12, Au.26	0.07½
Lucky Jim	Spokane	*15⅜	*15¼	*15⅜		
Lucky-Tiger Com.	Kansas City	†7.25	†7.00	....	Nov. 20, 1926	0.10
Mammoth Mining	Salt Lake	2.55	2.55	2.55	Mar.24, Apr. 1	0.10
Marsh Mines	Spokane	3	2⅞	2⅞	Se.15, Oc.19	0.15
Park Utah	New York	6.50	6.25	6.25	Se.15, Oc.1 Q	0.15
Plutus Mining	Salt Lake	....	....	1.87½	Oct. 15, Q	0.15
Prince Cons.	Salt Lake	....	....	2¼		
Silver King Coal	Salt Lake	7.80	7.55	7.80	Se. 20, Oc.1, Q	0.25
Silversmith	Spokane	*38⅛	*38	*38	Oc.1, Oc.10 Q	0.02
Strattons Mines	Spokane	*46	*40	*46		
Tamarack-Custer	Spokane	*45½	*37	*45½	Sept., 1924	0.25
Tintic Standard	Salt Lake	11.25	11.25	11.25	Se.13, Se.25 QX	0.40
Utah-Apex	Boston	6¼	5⅛	5 1/16	Oc.3, Oc.15 Q	0.25
Western Utah Copper	N. Y. Curb	....	....	*5		
IRON						
Bethlehem Steel	New York	45⅜	44⅛	44⅛	July, 1924	1.25
Cleveland-Cliffs Iron	Cleveland	80	78	78	Oct., 1926	1.00
Colorado Fuel & Iron	New York	42⅜	40⅛	42⅛	May, 1921	0.75
Gt. North'n Iron Ore	New York	22	19⅛	19⅛	Dec.6, Dec.28	0.75
Inland Steel	New York	41	41	41	No.15, De.1 Q	0.62½
Mesabi Iron	N. Y. Curb	...	...	1⅛		
Replogle Steel	New York	10⅜	9⅛	10⅛		
Republic I. & S.	New York	58	55	57⅜	No.15, De.1 Q	1.00
Republic I. & S. pfd.	New York	97¼	96	97¼	De.15, Ja.2 Q	1.75
Sloss-Sheffield S. & I.	New York	124	121	123	Se.10, Se.20 Q	1.50
Sloss-Shef. S.&I. pfd.	New York	107	107	107	Se.20, Oc.1 Q	1.75
U. S. Steel	New York	151⅞	143⅛	149⅞	De.1, De.30 Q	1.75
U. S. Steel pfd.	New York	128⅜	127⅛	128	No.2, No.29, Q	1.75
Virginia I. C. & C.	New York	60⅛	51	59	Jan., 1924	1.50
Virginia I.C.&C.pfd	New York	78	78	78	Jn.1, July 2, SA	2.50
DIAMONDS, PLATINUM, ALUMINUM, VANADIUM						
De Beers Consol.	New York	35⅜	35⅛	35⅛	Ju.16, Ju.17	1.70
So. Am. Gold & P.	N. Y. Curb	4⅛	4⅛	4⅛		
Alum. Co. of Amer.	N.Y.Curb	69⅞	69⅞	69⅞		
Alum. Co. of Amer pf.	N.Y.Curb	102⅛	102⅛	102⅛	Oct.1, Q,	1.50
Vanadium Corp.	New York	42⅜	39¾	41⅝	De.1, De.15, X	1.00
ASBESTOS						
Asbestos Corp., New	Montreal	24⅞	23	23⅜	Jan., 1926	1.50
Asbestos Corp., pfd.	Montreal	82⅛	81	81¼	Jy.1, Jy.15, SA	1.75
SULPHUR						
Freeport Texas	New York	31⅛	29⅜	30⅛	Nov., 1919	1.00
Texas Gulf, new	New York	48⅜	46⅛	47	Se.7, Se. 15, Q	3.00
MINING, SMELTING, REFINING AND GENERAL						
Amer. Metal	New York	48⅞	46⅜	47⅛	No.19, De. 1, Q	1.00
Amer. Metal pfd.	New York	...	...	114	No.20, De.1 Q	1.75
Amer. Sm. & Ref.	New York	140	134	137⅞	Oc.15, No.1, Q	2.00
Amer. Sm.&Ref.pfd.	New York	118⅜	118¼	118⅛	No.5, De.1, Q	1.75
Consol. M. & S.	N. Y. Curb	...	...	300	Jn.30, Jy.5 SA	X3.75
Federated Metals	N. Y. Curb	....	....	12		
Newmont Mining	N. Y. Curb	75¾	73⅛	74	Oc.1, Oc.15, Q	0.60
Southwest Metals	N. Y. Curb	....	....	1		
U. S. Sm. R. & M.	New York	37	31⅛	36	Oc.7, Oc.15, Q	0.87½
U. S. Sm. R.&M.pfd.	New York	45	44	45	Oc.7, Oc.15, Q	0.87½

* Cents per share. † Bid or asked. Q, Quarterly. SA, Semi-annually. M, Monthly. F, four weeks. I, Initial. X, Includes extra. The first date given is that of the closing of the books; the second that of the payment of the dividend.

Boston quotations courtesy Boston Stock Exchange; Toronto quotations those of the Standard Stock Exchange of Toronto, by courtesy of Arthur E. Moysey & Co.; Spokane, Pohlman Investment Co.; Salt Lake, Stock and Mining Exchange; Henry Sachs, Colorado Springs, Colo.

PRICE WEEK ENDED NOV. 2, 1926

Name	High	Low	Last		Last Divd. Date	Amount
Aramayo Mines (25 frs.)	78/9	76/3	78/9	Aug.	1926	15 p.c.†
British Platinum (£1)	4/6	3/—	4/—	Feb.	1925	2½ p.c.
Burma Corpn. (10 rupees)	15/—	14/6	14 7½	Aug.	1926	7 annas*
Bwana M'Kubwa (5s)	7/6	7 1½	7/3			
Camp Bird (2s)	3/6	2/6	2/9			
El Ore (£1)	5/10½	5/4½	5/6	Nov.	1924	2½ p.c.*
Esperansa (10s)	—/9	—/7	—/9			
Frontino & Bolivia (£1)	8/9	8/6	8/9	July	1926	2½ p.c.
Mexican Corpn. (£1)	11/1½	10/6	10/6			
Mexico Mines of El Oro (£1)	21/3	20/—	20/—	June	1926	7½ p.c.*
Oroville Dredging (£1)	3/—	2/6	2/6	Dec.	1923	3¾ p.c.
Ouro Preto (£1)	2/3	1/10½	2/—	May	1925	2½ p.c.
Rhodesian Congo Border (£1)	110/—	101/3	105/—			
St. John del Rey (£1)	9/7½	8/6	9/—	June	1925	6½ p.c.
San Francisco Mines (10s)	33/3	32/9	32/9	June	1926	15 p.c.
Santa Gertrudis (£1)	14/3	12/10½	13/6	Oct.	1926	3¾ p.c.
Selukwe (2s. 6d.)	12/7½	12/3	12/6	April	1917	6¾ p.c.
S. Amer. Copper (2s.)	4/—	3/9	4/—	Nov.	1917	75 p.c.
Tanganyika (£1)	45 6	42/6	43 9	Aug.	1926	7½ p.c.
Tomboy (£1)	3/6	3/4½	3/6	July	1926	10 p.c.
Union Miniere du Haut-Katanga (Brussels)	9.250	8.700	8.950	July	1926	175 (‡)

* Free of British income tax. † Swiss frs. ‡ Belgian frs. and free of taxation